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The Fresh-Water Fishes of Maine

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THE FRESH-WATER FISHES OF MAINE

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Introduction.

The purpose of this investigation is to determine the present status of the fish fauna of Maine. Data assembled during the course of this study includes descriptions of native and introduced species, records concerning their present distribution, and the extent of the official introduction of non-indigenous species. From this material may be derived conclusions respecting the survival of the introduced species and the probable capacity of the native species to successfully compete with them. Through the use of descriptive material assembled during the investigation of species it has been possible to construct a key as an aid in identifying any species of fresh-water fish now found in the state of Maine. It is expected that information of this character may be useful in the development of a program of biological control of Maine aquatic resources.

History of Work Done on Maine Fishes.

In 1862 Dr. Ezekiel Holmes published a catalogue of Maine fishes. The list is incomplete and the termnology is different from that used at the present time so the work is useful mainly from an historical point of view, it being the first work of note on that subject.

In 1914 Kendall, of the U. S. Bureau of Fisheries published a catalogue and bibliography of the fishes of Maine, the aim of which was to include at least one record of each species known to occur in the waters of the state. By the term record is meant a published

notice that a fish has been collected in Maine, bearing the technical name of the species, the definite locality and the date of publication. Kendall has also written other articles concerning Maine fish the chief of which is "Rangeley Lakes: Fishes, Angling, and Fish Culture."

We also have the reports of both State and Federal Fish Commissions. In 1867 the first State Commission was appointed and since 1872 the U. S. Fish Commission has co-operated in the work of fish propagation.

Acknowledgment.

The details of species description closely follow the work of Jordan and Evermann "Fishes of North and Middle America," published as Bulletin 47 of the U. S. National Museum, or from "Fishes of Illinois," which is based largely on the former volume. The description of three Maine fish not found elsewhere is based on Kendall's "Notes on Some Fresh-Water Fishes from Maine."

Causes of the changing Fish Fauna of Maine.

Maine waters are distinguished by lower temperatures, swifter current and higher oxygen content than is found in other New England states. This has profoundly affected the fauna of Maine streams and lakes. The lake bottoms and river beds are largely composed of gravel which may be of glacial origin. These natural conditions, however, are gradually being changed through the intervention of man.

A change in environment is brought about indirectly in several ways, the most important of which is due to deforestation, with consequent changes in the physical condition of the waters. The building of dams causes a change in water level with concomitant change in temperature, as well as forming an obstruction in the river basin. A third environmental factor is contamination from various manufacturing industries such as pulp and paper mills, saw mills, and from sewage. All of these environmental factors are bound to bring about a change in fish fauna. Deforestation has caused small brooks, the natural spawning and feeding grounds for trout, to dry up. It has lowered the water level and raised the temperature of the water. The distribution of brook trout is governed mainly by the temperature of the water. In its natural habitat this fish does not endure a temperature over 65° F. In many of the long-settled portions of the country where the woods have been cut from the surrounding area and from banks of streams the trout has practically disappeared.

Pollution of the waters may be indirectly responsible for decrease of

fish by making the food supply unavailable. Sawdust or sewage may cover the bottom or sides of the river and thus make it impossible for the fish to feed upon the aquatic insects and micro-organisms available under natural condition.

Another cause for diminution in the numbers of fish is excessive and untimely fishing, particularly the catching of fish on their spawning beds and through the ice in winter.

The character of the fish population has changed through the introduction and spread of new species and by the decrease in number of minnows and other fish fed upon by the new species. For example, the pickerel has spread over a wide area to which it was not native. In regions where trout once lived and where pickerel now occur, the depletion of trout has been ascribed to pickerel. The latter do eat other fish, but may not be as harmful as some other species due largely to the fact that they usually inhabit shallow, weedy places. Such deadwaters, however, may be at the mouths of inflowing streams which are natural trout nurseries. Then when trout attempt to descend toward the lake in search for deeper and cooler water, they come in contact with the pickerel which are lying in wait there.

The effect of introducing landlocked salmon into trout waters has proved more disastrous than has the introduction of pickerel. A specific example taken from Kendall's work may be cited to prove this. The blueback trout was originally discovered in the Rangeley Lakes in 1854. When they ascended the streams in October to spawn they were caught in dip nets

by the barrel and cured by the inhabitants for winter use. The fish at the present time is nearly if not absolutely extinct in those waters. The alleged cause of the decrease was the excessive and unseasonable fishing by the inhabitants of the shores of the lakes. But these people had fished in the same way for 50 or 100 years with no perceptible decrease in the number of trout.

One of the first acts of the State Fish Commission after its establishment was to introduce landlocked salmon in the Rangeley Lakes. The decrease in the number of blueback trout was in direct ratio to the increase in the numbers of landlocked salmon. This decrease has occurred in spite of the fact that large annual plants of young trout have been made.

Discrimination should also be used in the introduction of black bass. The small-mouth black bass was not originally a native fish, but it has become so well established and so widespread that it is now generally considered a Maine fish. Under favorable conditions the black bass grows and multiplies rapidly so that in a few years those waters into which it has been introduced have become completely stocked. Black bass like most fish will eat other fish.

There are two possible injurious effects of the introduction of nonindigenous fishes: First, and most important, the destruction of the native fishes by introducing voracious forms and second, the diminution of the food supply of native fish due to over-stocking of the water.

The State and Federal hatcheries plant a great many fishes in Maine

waters annually as seen by the following reports:

Report of U. S. Commissioner 1926.

Humpback salmon	998,900
Landlocked salmon	554,155
Brook trout	1,119,880
Crappie	600
Large mouth black bass	100
Small mouth black bass	2,455

Report of State Commissioner 1924.

	Number of fish planted		
Hatchery	Landlocked salmon	Square-tailed trout	Togue
Auburn	52,075	342,400	-
Belgrade	114,170	131,900	-
Caribou	160,000	159,000	-
Enfield	40,200	181,000	9,370
Knox County	92,500	285,000	-
Monmouth	-	324,350	45,000
Moosehead	185,150	175,000	-
Moxie	-	304,200	-
Oquassoc	130,000	427,900	-
Raymond	247,850	-	-
Tunk Pond	39,500	236,500	-
	1,061,445	2,567,250	54,370

As may be inferred from the reports, the present tendency is to limit the number of nonindigenous species in contrast to the policy of past years when a large number of exotic, or other non-native fishes were introduced with a hope of increasing the number of species.

There are various reasons why some of these introduced forms have never been observed again. The water may not have been of the right temperature; they may have been devoured by predaceous fishes; the food supply may not have been ample, or it is possible that they may have resembled other species so closely that they were not recognized when caught.

The accompanying lists comparing the fishes that have been introduced in Maine waters with those that have been reported since their introduction justify the present policy of limiting the number of species.

The following is a list of the different species of fish sent to Maine by the United States Bureau of Fisheries during the years 1872-1926. (Strictly salt-water fishes as the cod and flounder are not included).

Catfishes (Siluridae):

* Horned pout (Ameiurus nebulosus)

Carps (Cyprinidae):

German carp (Cyprinus carpio)

Goldfish (Carassius auratus)

Shads (Clupeidae):

*Shad (Alosa sapidissima)

Salmon, trout, whitefishes (Salmonidae)

Common whitefish (Coregonus clupeaformis)

Chinook or quinnot salmon (Oncorhynchus tschawytscha)

Humpback salmon (Oncorhynchus gorbuscha)

Silver salmon (Oncorhynchus kisutch)

Sockeye salmon (Oncorhynchus nerka)

Steelhead salmon (Salmo gairdneri)

*Atlantic salmon (Salmo salar)

*Landlocked salmon (Salmo sebago)

Black-spotted trout (Salmo lewisi

Rainbow trout (Salmo irideus)

Scotch sea trout (Salmo trutta)

Loch Leven trout (Salmo levenensis)

Von Behr or Brown trout (Salmo fario)

Swiss Lake trout (Salmo lemanus)

*Lake trout (Cristivomer namaycush)

*Brook trout (Salvelinus fontinalis)

*Golden trout (Salvelinus aureolus)

Saibling (Salvelinus alpinus)

Graylings (Thymallidae)

Montana grayling (Thymallus montanus)

Smelts (Argentinidae)

*American smelt (Osmerus mordax)

Basses, sunfishes, and crappies (Centrarchidae)

Crappie (Pomoxis annularis)

Small-mouth black bass (Micropterus dolomieu)

Large-mouth black bass (Micropterus salmoides)

Perches (Percidae)

Pike-perch (Stizostedion vitreum)

Sea Basses

*White perch (Morone americana)

*indicates indigenous species.

The following list indicates those species not native to Maine that have been reported from one or more localities since their introduction.

Foreign	American
1. Carp	1. Whitefish
2. Goldfish	2. Chinook salmon *
3. Scotch sea trout	3. Rainbow trout
4. Brown trout	4. Small-mouth black bass
	5. Humpback salmon

*reported once.

It is possible to conceive of a natural succession in Maine waters. Ponds and brooks that were once the natural habitat of trout but which no longer contain them may in time undergo changes that will make them again favorable for trout by passing thru the following cycle.

Due to deforesting of areas along the banks and in the surrounding region the water level may become lowered with concomitant rise in

temperature and decrease in oxygen content. This would cause a change in the number and kind of micro-organisms present as well as in the aquatic insects and minnows. The diminution of the number of trout would be inevitable under these conditions.

There would be an increase in width of pond margins due to lowering of the water with a consequent growth of sedges, grasses and "pickerel weed." These conditions would be favorable for such fishes as pickerel, perch and bass, and by introducing these fish the waters would become completely stocked in a few years. The trout would gradually be reduced in numbers and finally disappear, and the pickerel, perch, and bass would become dominant. Minnows, such as the top minnow (Fundulus diaphanus) and the golden shiner (Abramis crysoleucas) would also find these conditions favorable to them. They can live in very shallow water and are found around margins of ponds for here they can best escape their enemies by remaining in water that is too shallow for the larger fish.

After a number of years the forests may grow up again. Due to the general present tendency for people to move to the towns and cities there are many areas in Maine that were once prosperous farming districts but now have become practically deserted. Furthermore, lumbering in Maine no longer holds the important place among industries that it did formerly.

So we can easily conceive of a gradual return to former conditions. As the forest grows the water will rise since evaporation will be checked in the brooks feeding the larger streams, and due to the shade

the water will decrease in temperature. The water level in the ponds will be raised and thus the breeding grounds of pickerel, perch, and bass will be nearly eliminated; the minnows will no longer receive the protection or food supply formerly found. The increased competition between the other fishes would decrease their numbers.

Finally a few large trout might find their way to the brooks which would be suitable for spawning. After a time the trout, finding ideal conditions, would increase in numbers. The pickerel, perch and bass would be reduced in numbers and then the trout would become dominant once more.

In many cases, to make this cycle possible, it might be necessary for the pond to be restocked with trout as conditions became favorable for their development.

Twenty species of nonindigenous fresh-water fishes have been introduced in Maine since 1872. Soon after the U. S. Commission was established many different kinds of food and game fish were introduced in an attempt to increase the number of species. It is significant that only nine of the twenty have ever been reported at all and none of them, except the small-mouth black bass, are of common occurrence.

At the present time the policy is to introduce fewer species, but to increase the numbers of trout and other Salmonidae which have proved successful in Maine. But we might well question the advisability of introducing as many species as were sent out by the U. S. Fish Commission in 1926. The crappie, small-mouth bass, and large-mouth black bass were among the list in the Commissioner's report for that year. In 1917 the pike perch was introduced in Pushaw Lake, Orono.

It would seem advisable that the time and labor should be spent on introducing trout and landlocked salmon, especially as these highly prized food and game fishes are not found to any extent farther south. Many tourists come to Maine to fish for trout and salmon, but they do not care particularly for catching fish, such as the basses, which are native to their own state.

The following notes on some of the introduced species will help to show why discrimination in introduction of fishes is necessary.

Notes on some of the Introduced Species.

Quinnat salmon (Chinook or Pacific salmon). This salmon has been planted from time to time in many eastern waters, some being placed in fresh-water lakes. The results have not been very encouraging, the most successful being in Sunapee Lake, N. H. Salmon were planted in Lake Ontario waters in 1879 and again in 1897 and 1898, but only one was ever reported.

No more were reported until 1903 when the State Fish Commissioner of Maine wrote to the U. S. Fish Commissioner stating that quinnot salmon, some of which weighed as high as 16 pounds were being caught in Pierce Pond in Somerset County. An investigation proved that the fish were landlocked salmon. Two years later small fish of one or one and one-half pounds stated to have been caught in Pierce Pond, were sent to the Academy of Sciences in Philadelphia and U. S. National Museum and proved to be quinnot salmon. However it is significant that Pierce Pond has not been heard from subsequently as a habitat of quinnot salmon.

For the stock to be self-sustaining conditions both for growth and for reproduction must be favorable. The conditions for growth may be favorable in Pierce Pond but it is doubtful if other conditions permit the fish to mature and breed there. It has not been definitely ascertained when they reach the breeding age. In California it is at the end of the fourth year and in Alaska at the end of the fifth year. The fish die after spawning, which would mean a complete disappearance

of each years plant and the end of the fourth or fifth year.

Silver salmon. Its geographical range is from San Francisco to the Yukon. It reaches a weight of 15 pounds and probably averages eight or nine pounds. Like the quinnot salmon all die after the breeding function is performed. The adult fish subsists largely upon other fish particularly upon those that swim in schools.

It is a good fish and a gamy fighter, but does not excel the landlocked salmon. Due to the fact that it is a voracious fish eater it is doubtful whether anything can be gained by its introduction in Maine waters.

The landlocked salmon. This fish originally was found in only four river basins;- the St. Croix, Union, Penobscot and Presumscot. In the St. Croix it occurred in some of the lakes of both branches, but the western branch at Grand Lake is the best known water for it now. This is the source of the "Schoodic salmon" of fish culture. In the Union basin it was found only in Green Lake. In the Penobscot, the only water in which it was formerly known is Sebec Lake; and in the Presumscot, Sebago Lake was the only habitat of this species. From this lake the fish gets its name and there it attains the largest size of any of the waters mentioned.

The landlocked salmon requires for breeding a gravelly bottom with cool running water. It ascends streams to the spawning beds, where it forms its nest some time before it is ready to deposit its eggs. The spawning takes place mainly in November. The eggs hatch in the spring

and the young remain in the streams until they are four or five or sometimes eight or ten inches long.

The adult landlocked salmon is primarily a fish eater but it also lives on insects. In its natural habitat the smelt is its principal food and no landlocked salmon ever occurred naturally where there were no smelts. In fact, the spring runs of the sea salmon seem to be in pursuit of food to some extent, and on the Maine coast this is largely the smelt.

This fish is unsurpassed as a game fish and is an excellent food fish. Its size and activity make it attractive to the angler. However it is an undesirable acquisition where it is desired to maintain the stock of trout. The greatest damage has been done in those waters where it was introduced without a preceeding or accompanying introduction of smelts.

Rainbow trout. The rainbow trout occurs naturally in the streams of the west slope of the Sierra Nevada and the Coast Range Mountains and is found as far north as southeastern Alaska. It generally spawns in December and January.

The fish has been successfully transplanted into streams in the Eastern States where the conditions seem to be favorable. Rainbow trout will live in warmer water than the brook trout. Probably warmer waters are required and the coldness of the New England waters may be the cause of the poor results in stocking them with this fish.

It is a profusely black spotted fish, and could be confused with no

other salmonoid unless possibly the quinnot or the landlocked salmon.

Brown trout or Von Behr trout. This trout was first introduced from Germany. It has been introduced into many U. S. waters, in some of which it has thrived. It is a good game fish, but not equal to the native brook trout. It will endure warmer water than our brook trout and may be suited to depleted trout streams, which, owing to change of conditions, are unsuited to them.

Loch Leven trout. (Salmo levensis). This trout derives its name from the lake or loch in Scotland knwon as Loch Leven. It is stated that fish reared from Loch Leven trout eggs in some waters cannot be distinguished from the brown trout. Day contends that the Loch Leven trout is but a local variation of the brown trout.

Lake trout, (Salvelinus namaycush). It is found on eastern and western coast of U. S. and as far north as the Arctic Circle. In some waters it reaches a weight of 100 pounds and varies much in size and color in different waters. "It is a voracious fish, subsisting mainly on other fishes and is better entitled to the cognomen of 'freshwater shark' than the pickerel or pike."

It spawns in the fall like other New England Salmonidae, and usually upon shoals in the lakes.

In some sections it is highly esteemed as a food fish; in others it is regarded as inferior; as a game fish it is also variously regarded. Its principal virtue as a game fish consists of its power and the size attained.

Brook trout (Salvelinus fontinalis). The distribution of Salvelinus fontinalis is governed mainly by the temperature of the water, and in its natural habitat it seems not to endure a temperature of over 60° or 65° F.

The trout varies in size according to the conditions of environment, in some waters attaining maturity when small and remaining small. In other places it grows rapidly, attaining a considerable size before maturity and reaching a weight of ten pounds or more. Trout do not reach a large size on exclusively insect diet, probably because such food is seldom sufficiently abundant to supply the required nourishment to a large number of fish.

The habit of trout spawning in brooks whenever possible and that of the young remaining in them for some time indicate that the brooks afford the most natural conditions in which to plant trout. Trout fry undoubtedly remain in the brooks over winter and food for such small fish is far more plentiful there than in a lake.

The Golden trout(Salvelinus aureolus). The golden trout is closely related to, if not specifically identical with the European Charr otherwise known in this country by the name German "saibling", Salvelinus alpinus. It also closely resembles the blueback of Rangeley Lakes so that the identification of three species is difficult. However, the Rangeley blueback has been planted in various lakes of Maine and New Hampshire, but none has since been reported.

The most conspicuous external difference between the golden or white

trout of Sunapee Lake, N. H. and the blueback is of color, and that is not very pronounced. The spots are more numerous and smaller in the latter and the under side of the pectoral fin has a narrow margin of white. Other differences such as number of rays in anal fin may be distinguishing characteristics.

The Grayling (Thymallus montanus). The habits of this grayling are described by Dr. Henshall as follows: "The Montana grayling prefers swift clear streams of pure water, with gravelly or sandy bottom. It is quite gregarious, lying in schools in the deeper pools, in plain sight, and not like the trout concealed under bushes or overhanging banks. In search of food, which consists principally of insects and their larvae, it occasionally extends its range to streams strewn with bowlders and broken rocks. As a food fish it is fully as good as the trout, and to my taste, better. As a game fish it is the equal of its congener, the red-throat trout, and when hooked, breaks water repeatedly in its effort to escape, which the trout seldom does."

If the grayling could be acclimated to our waters, it could not do much harm as it is mainly as insect feeder.

The Smelt. In some ponds the smelts are sexually mature when only two or two and one-half inches long while in other ponds they may grow to be ten or fifteen inches long. This difference may be due to a difference in food supply or other conditions.

Every spring after the ice leaves the lake and the freshets in the brooks have subsided the smelts usually begin to ascend the streams to

spawn. The "run" is usually by night. The spawn is deposited upon and adheres to stones, sand, moss, sticks, or any other object with which it comes in contact.

The smelt is not free from enemies even in the brook. The birds take the adult smelt, as does the trout to some extent, but the trout and chub feed mainly upon the eggs and young, and the smelt is not averse to its own eggs.

It is the natural food of landlocked salmon, and the salmon thrives only where there are smelts.

On the other hand where smelts are very plentiful the angler complains that the fishing is greatly interfered with as the fish will not take the fly and rarely any other bait except live smelts.

Black Bass. (Micropterus dolomieu). The small-mouth black bass is a member of the sunfish family. Under favorable conditions the black bass grows rapidly and may attain a weight of eight pounds. It also multiplies rapidly so that in a few years the waters into which they have been introduced may be completely stocked. Some individuals claim that there is a decided advantage in introducing black bass because they eat such fish as the yellow perch which is destructive to young trout. There are others that claim that the bass also destroys the trout. It is doubtful whether bass should ever be planted where there are trout and salmon because if the bass are plentiful they retard the increase of both trout and salmon. They also eat other fish, including the smelts, thus reducing the quantity of food for the salmonidae.

Pike Perch (Stizostedion vitreum). The pike perch is a member of the perch family along with the yellow perch. It is by far the largest species, sometimes attaining a weight of twenty pounds. It is a voracious, carnivorous fish, residing in the colder waters of the lake or river. As this is the natural habitat for the trout, its introduction in waters containing trout would be unwise.

Explanations of Terms and Measurements.

1. General Body Proportions.

The length of the fish is measured from the tip of the snout to the base of the caudal rays. It does not include the caudal fin and does not necessarily include the last scales, which in most scaled fishes encroach more or less on the base of the fin.

The depth of the fish is the vertical distance through the body at its deepest part. The expression depth 4 in length would mean that the depth is contained 4 times in the length or that the depth is 1/4 the length.

The width of the fish is taken at the widest part of the body.

The caudal peduncle, or tail, is the tapering portion of the body behind the base of the last ray of the anal fin. Its length is taken from a vertical from that point to the base of the mid-caudal rays. The depth of the caudal peduncle is taken at its slenderest part.

The profile is the curve from the front of the dorsal fin to the tip of the snout.

2. The Head and Contiguous Parts.

The length of the head, ordinarily called "head" in descriptions, is measured from the tip of the snout to the extreme hinder margin of the bony portions of the opercle.

The width of the head is taken at its widest part.

The nose, or snout, is measured from the tip of the upper jaw to the anterior margin of the eye.

The length of the upper jaw, referred to as "maxillary" in descriptions, is measured from the tip of the upper jaw (premaxillary symphysis) to the posterior end of the maxillary.

3. The Fins.

Fins may be either soft or spinous, or may consist partly of soft rays and partly of spines. The rays of the soft fin are distinguished from spines by their articulated or jointed structure. The peculiar "cross-marks" on the soft ray are as a rule easy to make out with the naked eye. In counting the fin rays, rudimentary rays are omitted. Rudimentary rays are those rays, in general, at the beginning of the fin which are unbranched, membraneless, closely oppressed the one to the other, and in ordinary cases not more than half the length of the fully developed rays. This limitation does not, however, apply to the so-called "club-shaped" short first dorsal ray of certain Cyprinidae (Pimephales and Cliola spp), which is separated from the ray back of it by a well-developed membrane. The last ray of the dorsal and anal fins is often split nearly or quite to the base and appears as two rays, although counted as only one. In descriptions, Arabic numerals are used to indicate fin rays, and Roman numerals to indicate spines. If a fin contains both spines and soft rays in a continuous series, a comma is used to separate the numerals indicating the two portions, "Dorsal X, 13" for example indicating a single dorsal fin with 10 spines and 13 soft rays. Two separate dorsal fins are indicated by a dash separating the numerals, "Dorsal X-12" and "Dorsal X-1, 12," indicating respectively: first, a

single spinous dorsal of 10 spines followed by a separate soft dorsal of 12 rays; and second, a spinous dorsal of 10 spines followed by a separate second dorsal fin consisting of a single spine and 12 soft rays.

The height of a fin is measured on the longest ray.

The length of a fin is measured along its base.

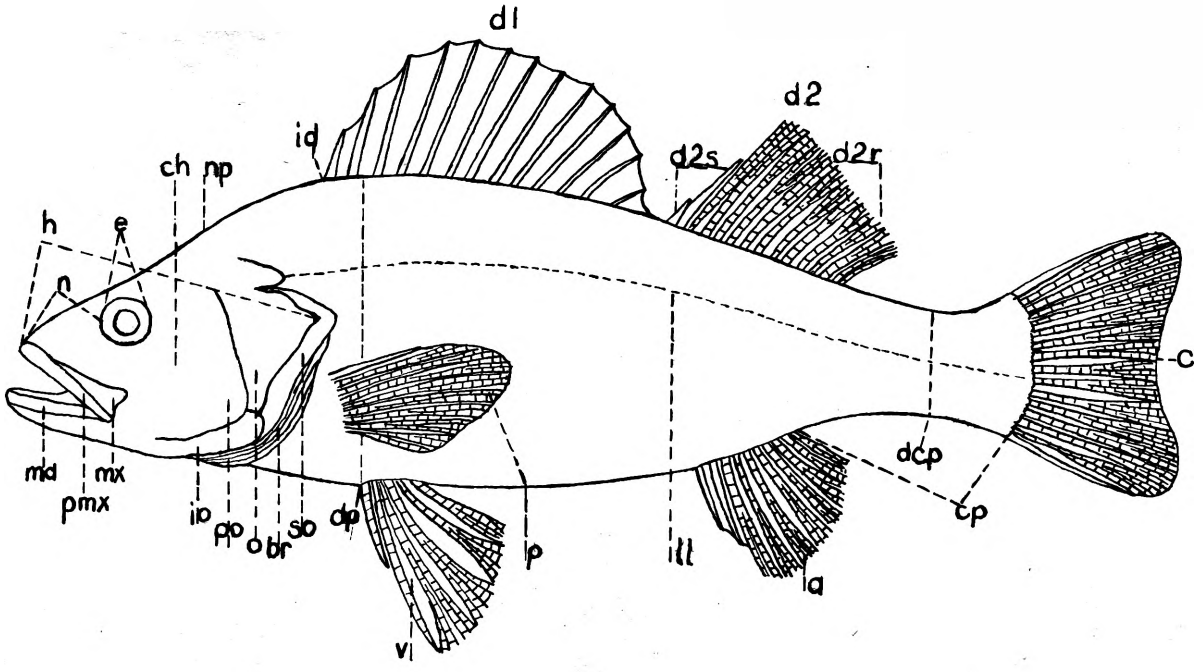
The origin or insertion of a fin is that of its first ray, or spine.

The position of a fin is the distance from the tip of the snout to the base of its first ray or spine. For example, it may be said of a fish that the "position of the dorsal fin" is contained more, or less, than twice in the fish's length.

4. The Scales.

The most ready indication of the size of the scales in a fish is furnished by the enumeration of the scales in the lateral line, or, if that is absent, of those in a line along the horizontal axis, as nearly as possible, from the upper corner of the gill-openings to the base of the caudal rays. It is customary in descriptions to include also counts of the scales in oblique series from the middle line of the back to lateral line and including it; and the number between the lateral line (not including it) and the median line of the belly in front of the anal fin. These counts are expressed in a conventional formula, "Scales 6-42-9," for example, indicating 6 scales in an oblique series above the lateral line, 42 in the lateral line (or in a longitudinal series from the gill-opening to the base of the caudal rays), and 9 in an oblique series below the lateral line.

EXTERNAL FEATURES



a, *anal fin*
b, *branchiostegal rays*
c, *caudal fin*
ch, *cheek*
cp, *length, caudal peduncle*
d1, *spinous dorsal fin*
d2, *soft dorsal fin*
d2r, *rays of second dorsal fin*
d2s, *spines of second dorsal fin*
dcp, *depth, caudal peduncle*
dp, *depth (of body)*
e, *eye*
h, *length of head*
id, *insertion of dorsal fin*
io, *interopercle*
ll, *lateral line*
md, *lower jaw or mandible*
mx, *maxillary*
n, *nose or snout*
np, *nape*
o, *opercle*
p, *pectoral fin*
pmx, *premaxillary*
po, *preopercle*
so, *subopercle*
v, *ventral fin*

Key for the Identification of
the Fresh-water Fishes of Maine.

Trace the characters of the specimens with what is said under each succeding letter, until there is a disagreement, or the name of the fish has been reached. When a disparity occurs, go to the double of the letter under which it occurs and proceed as before until another disagreement or a name is found, and so on.

a. With long barbels.

b. With lateral and median horns.

c. With adipose fin.-- HORNED POUT.

bb. Without lateral and median horns.

d. Body very elongate. Posterior dorsal fin very long and low. CUSK.

aa. Without long barbels

e. With suctorial mouth

f. Fins without spines

g. Snout long; scales comparatively small, about 104. LONGNOSE SUCKER.

gg. Snout not very long; scales larger.

h. About 67 in lateral line--COMMON SUCKER.

hh. No lateral line present. 36 to 45 scales in longitudinal series. CHUB-SUCKER.

ee. Without suctorial mouth.

i. With only one dorsal fin. *No spines.*

j. Scales very minute and deeply embedded in the skin; body serpentine; dorsal and anal fins

continuous with caudal around tail.— EEL.

jj. Scales small and inconspicuous.

k. Lateral line incomplete.

l. Two dark stripes along side.— RED-BELLIED DACE.

ll. One dark stripe along side.—

m. No barbel.—BRONZE MINNOW.

mm. Barbel usually present-CHUB MINNOW

kk. Lateral line complete.

n. Head short and rounded; first dorsal ray club-shaped—BLUNT-NOSE MINNOW.

nn. Snout long and prominent; distinct black lateral stripe.—BLACK-NOSE DACE.

jjj. Scales larger and conspicuous.

o. Mouth large with bands of sharp teeth; dorsal fin situated posteriorly—PICKEREL.

oo. Mouth small; pointed teeth; 15 to 20 dark transverse bars on each side; length three inches.— TOP-MINNOW.

ooo. Mouth not especially large; no teeth; back fin not placed posteriorly.

p. Pectoral fins not reaching nearly to ventrals.

q. No black spot at base of dorsal fin

in front; scales not crowded anteriorly.
SILVER CHUB.

qq. Black spot at base of dorsal; scales smaller and crowded anteriorly.--
MUD-CHUB.

pp. Pectoral fins reaching nearly to ventrals.

r. Abdomen behind ventrals; fins with sharp keel-like edge over which scales do not pass; body much compressed. -- GOLDEN SHINER.

rr. Scales on side deeper than long.

s. Spring males mottled salmon pink.
COMMON SHINER.

ss. Fins pale, back brick-red.
BRIDLED MINNOW.

rrr. Scales on side not deeper than long; barbel on anterior side of maxillary.
CHUB-MINNOW.

ii. With adipose fin.

t. Mouth large with teeth on jaws and tongue.

u. Body spotted.

v. Body spotted with dusky or black spots; pectorals

and ventrals with white outer rays; 115 scales in lateral line.--LAND-LOCKED SALMON.*

vv. Body spotted with yellow; pectorals and ventrals with white outer margins.

w. About 200 scales in lateral line.

x. Spots without blue areola and unmottled back; belly orange.-- GOLDEN TROUT.

xx. Spots with blue areola and mottled back; red and yellow spots. BROOK TROUT.**

xxx. Coloration dark blue. Spots confined to sides of body.-- BLUEBACK TROUT.

vvv. Body with light colored spots; no red spots usually. TOGUE.

uu. Body not spotted, but plain

dusky or silvery.--

z. Generally distributed.

COMMON SMELT.

zz. In $C_o$bbosseecontee.

COBBOSSEECONTEE SMELT.

zzz. In Wilton Pond.

WILTON SMELT.

tt. Mouth small, with no teeth in jaws or tongue.

a'. With tubercles. LITTLE WHITEFISH.

a'a'. Body not compressed. Profile slightly concave. ROUND WHITEFISH.

a'a'a'. Profile straight. COMMON WHITEFISH.

iii. Without adipose fin.

b'. With dorsal spines.

c! With free spines.

d'. With two free spines.--TWO-SPINED STICKLEBACK.

d'd'. With five spines.-- BROOK OR FIVE-SPINED STICKLEBACK.

d'd'. With nine spines.--NINE-SPINED STICKLEBACK

c'c'. Without free spines but with spines in dorsal fin.

e'. Spinous and soft rayed dorsal fins confluent.

f'. Body short and deep.

g'. Opercular flap rather small. Lower part scarlet.

PUMPKINSEED, SUNFISH.

f'f'. Body comparatively elongate.

h'. Opercular flap very long and narrow; belly orange-red. LONG-EARED SUNFISH.

h'h'. Operculum ending in two flat points; dusky spot on end of operculum. SMALL-MOUTH BLACK BASS.

e'e'. Spinous and soft-rayed dorsal fins separate.

i'. Sides golden yellow with 6 or 8 dark bars; 2 anal spines. YELLOW PERCH.

e'e'e'. Dorsal fins more or less connected by membrane.

j'. Color olivaceous and silvery; 3 anal spines. WHITE PERCH.

j'j'. No anal spines; preopercle with simple spine; body naked. MILLERS THUMB.

*Landlocked salmon. The Rainbow trout (introduced) may be distinguished from landlocked salmon by the presence in the former of dark spots on the tail and usually a crimson stripe along the side. In the Steelhead trout (introduced) the smaller scales, few spots and pale coloration serve to distinguish it from the Rainbow trout.

** Brook trout. In the Brown trout (introduced) the back is spotted with rather large dark-colored spots, but is not mottled as it is in the brook trout.

Maine Fresh-Water Fishes.

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Ameiurus nebulosus (Le Sueur)
(Bullheads; horned pout)

Body typically elongate, never more than moderately robust; depth about 4 in length; profile long and almost straight; skin thin, fitting closely over top of head and nape, that of belly consisting of a very thin and delicate epidermal layer over a thick layer of unpigmented connective tissue. Size reaching 18 inches. Color variable, usually a rather dark yellowish brown, faintly clouded, sometimes nearly black; under parts including chin, breast and belly, pale gray, pinkish, or satiny whitish; nasal and maxillary barbels of same shade as top of head; lower barbels slaty to pinkish white, sometimes faintly marbled with darker. Head 3.2 to 3.6 in body, its length always considerably greater than its width; upper jaw usually distinctly longer than lower; maxillary barbel usually reaching considerably beyond gill-opening. Dorsal spine as a rule rather long; Anal fin 21 to 24 rays including rudiments. Free margin of fin, but little rounded, sometimes almost straight. Pectoral spine as a rule rather long, curved and sharply pointed, its length about 2 in head. Dorsal fin inserted rather nearer adipose fin than end of snout; pectoral spine in young with 5 to 10 well-developed strong and sharp teeth on its posterior edge, their length more than half the diameter of the spine, becoming more numerous and relatively reduced in size in adults black pigment on anal fin typically densest on membranes near their free margins, in spots forming an obscure longitudinal bar near base of fin. No scales. Air bladder connected with

organ of hearing by the auditory ossicles.

They are peculiar in their preference for stagnant water. They are fond of the mud and grow best in weedy ponds and rivers without current. They stay near the bottom, moving slowly about with their barbels widely spread, watching for anything eatable. They will take any kind of bait and seldom fail to swallow the hook. They spawn in Spring, and the old fishes lead the young in great schools near the shore, caring for them as a hen cares for her chickens.

These fishes will live where no others can survive, and when the air supply is bad far past the point of supporting life in ordinary fishes they have merely to come to the surface and renew the supply in their swim bladders. In the late fall they become sluggish and cease feeding, often burying themselves more or less in soft leafy ooze along shore. They will lie dormant in the mud at the bottom of dried-out shallows for weeks at a time without harm and have been found, in clods of nearly dried mud, still alive. In pond culture experiments in Georgia (Bull. U. S. Fish Comm., 1884, p.32) they were found to relish apples, persimmons, watermelons and even corn, wheat and sorgham seed. The charge of spawn-eating has frequently been preferred against this fish especially by whitefish and shad culturists. The evidence for such a view is however scanty.

The brown bullhead spawns in spring, the time having been May in 1898 at Havana, Illinois.(Craig) Their nests were found in shallow bays with sandy bottom, six inches to two feet deep. The eggs are laid in

masses similar to those of the frog, and are of a beautiful cream-color. In aquarium experiments by Smith and Harron (Bull. U. S. Fish Comm., 1902, p. 150) the eggs hatched in 5 days, during which time both parents constantly watched them, fanning them with their fins. At times the male will take masses of eggs into his mouth, possibly to clean them, as they are ordinarily soon ejected. The young are watched by the male and are sometimes mouthed as are the eggs.

This species is of fair food quality, being perhaps somewhat inferior to the yellow bullhead. It was successfully introduced about twenty years ago into Germany, France, the Netherlands and England. It has multiplied very rapidly since its introduction into California.

It is reported from lakes of New Brunswick to those of the Saskatchewan system including the Great Lakes in general, and from thence southward to the Florida peninsula and to Texas. It has been introduced also into many rivers of the Pacific states, and into the small lakes of southern Oregon, in all of which it has become excessively abundant. In Maine it is found in most of our fresh waters.

HORNPOUT *Ameiurus nebulosus*

Catostomidae (suckers)

The suckers are generally of sluggish habit and, as a rule, prefer water of a good depth and little current, but some of them may be found in almost every stream and pond within their range. Their spring migration is familiar to all fishermen, and to many who do not fish. They run up the smaller streams in May or June to deposit their eggs. The males of most species develop black or red pigment on the body and fins in spring, and in many kinds peculiar wart-like tubercles, called pearl organs, appear at this season on the head, fins and caudal peduncle.

They feed on the bottom of the waters they inhabit, and commonly upon the same kinds of foods, differing somewhat in respect to the places they seek it. Mollusks form a larger percentage of the food of cylindrical suckers, and Entomostraca and vegetable food a very much greater part of that of the deep bodied species. All of the species swallow much mud, since they collect most of their food from the bottom by suction, to which their protractile mouths and fleshy lips are peculiarly adapted.

As food fishes they do not hold a high place, the flesh being rather coarse, dry, and either flavorless or strong and always "Provokingly full of small bones."

Erimyson oblongus (Chub sucker) (Mitchell)

Body oblong, compressed, the depth increasing with age; predorsal region more or less elevated and profile angled at nape in old specimens; depth 3.1 to 3.9 in length. Size small, length about 10 inches. Coloration

varying considerably with age; in adults a nearly uniform brownish olive, intermixed with pinkish anteriorly, and everywhere with more or less of a coppery luster; paler below; fins dusky, ventrals and anals most so. In young specimens the sides are marked with four distinct bands of color: a dark band extending from occiput backward on each side of dorsal fin to middle of caudal peduncle, covering 4 upper rows of scales; below this a band of light color, extending from just above upper corner of gill-cleft to upper part of base of caudal; next, and most prominent, a narrow band of purplish black, extending from center of base of caudal forward along sides and through eye to end of snout; and beneath this dark lateral band the sides pale to the whitish or silvery belly. Adults are found which retain to a greater or less extent the markings of the young specimens 6 to 8 inches in length sometimes showing more or less plainly the dark lateral stripe, as well as the apportionment of color in bands above and below; the black lateral band may break up into indistinct bars with age, various stages between the barred condition and a uniform dusky coloration being found. Head short, compressed, considerably tapered, its length 3.5 to 4.1; mouth subterminal, rather small, mandibles more or less obliquely set, tip of upper lip in old specimens sometimes not far below level of lower rim of orbit; lower lip strongly plicate, its halves meeting in a rather acute angle; eye large. Dorsal fin a little higher than long, its developed rays 9 to 12. Scales large, 36 to 45 in longitudinal series, transverse rows 13 to 15; scales more or less crowded anteriorly and somewhat irregularly arranged on posterior half of body;

lateral line as a rule entirely wanting at all ages; specimens occasionally found with one or two imperfectly developed pores.

Head of spring males with three large tubercles on each side of snout, two in longitudinal series in front of eye, one lower down, near corner of mouth.

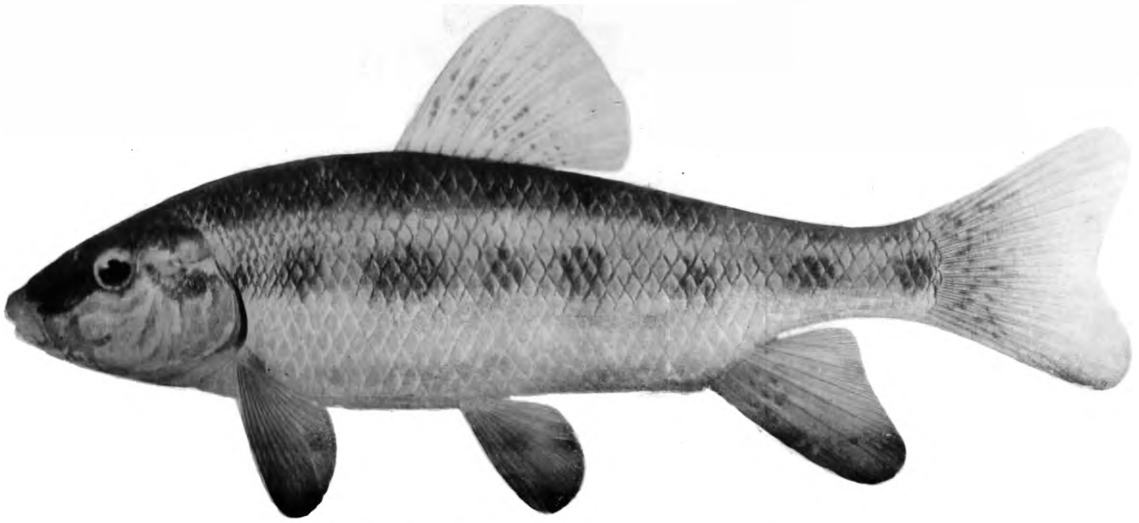
The chub-sucker is a bottom feeder, and has the habit of supporting itself on the bottom by means of its paired fins. Ripe males were taken at Havana, Illinois, in April and females with ripe ovaries from March 20 to April 15.

This fish bites readily at a small hook, but its flesh is bony and without flavor, and owing to its small size this species has no commercial value.

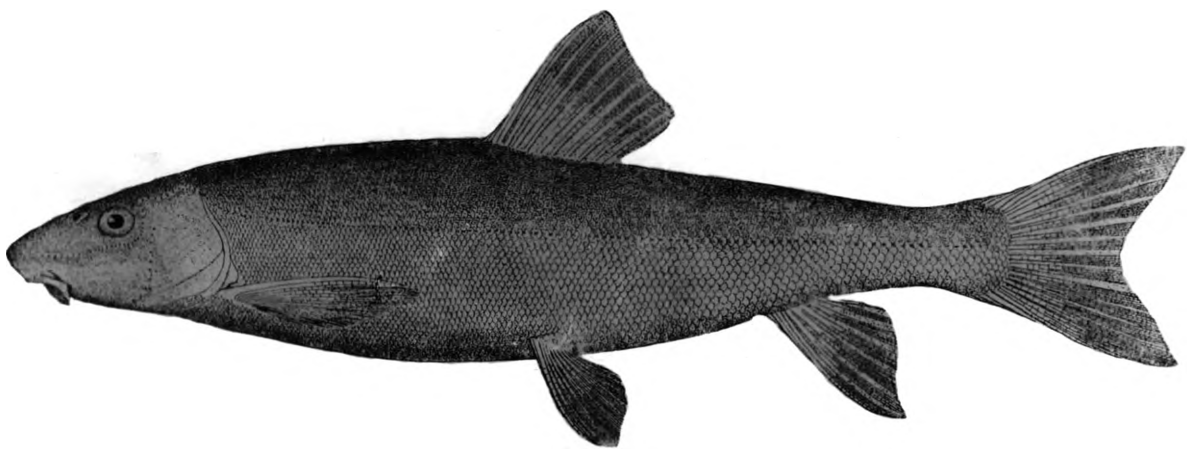
Its range is from the Great Lakes region, and the Dakotas south to Virginia, and, it is represented from Virginia to Texas by a typical Erimyzon sucetta. In Maine it is found only in the Presumscot river basin.

Catostomus catostomus (Forster).
(Long-nosed sucker; northern sucker; red sucker)

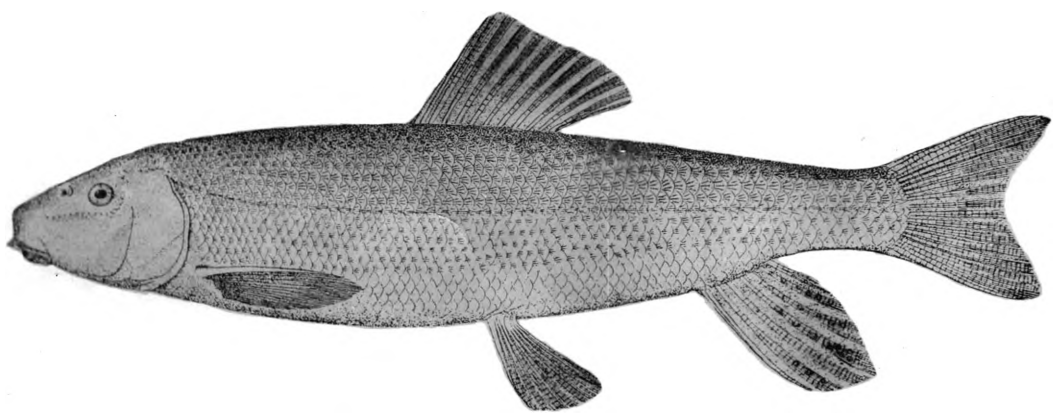
Body elongate, subterete, the depth 4 1/4 to 4 3/4 in length. Head quite long and slender, 4 1/4 to 4 2/3 in length, depressed and flattened above, broad at base, but tapering into a long snout, which considerably overhangs the large mouth. Lips thick, coarsely tuberculate, the upper lip narrow, with 2 or 3, rarely four, rows of tubercles; lower lip deeply incised; lower jaw with a short cartilaginous sheath. Eye rather small, behind the middle of the head. Scales very small, much crowded forward, 95 to 114 in the lateral line and about 29 (26 to 31) in



CHUB SUCKER, *Erimyzon oblongus*



LONGNOSE SUCKER, *Catostomus catostomus*



COMMON SUCKER, *Catostomus commersonii*

a cross row from dorsal to ventrals. Dorsal rays 10 to 11. Males in spring with the head and anal fin profusely tuberculate, the tubercles on the head small; the sides at that season with a broad rosy band. Size large. Length 2 1/2 feet.

According to Kendall (In "Fishes of Connecticut Lakes")"This species is regarded as a comparatively deep-water fish, seldom entering shallow water to breed or feed upon the eggs of other fishes. The food of the sucker consists mostly of small animal and vegetable life which it gathers at the bottom, but it has been seen to take insects at the surface and it doubtless will eat young fish. It is known to devour fish eggs. The stomach contents of the specimens collected consisted of a considerable quantity of fine algae, entomostraca, and larval insects. Many larvae of black flies were observed; very fine sand was also present. Some specimens were found with stomachs full of fish eggs, presumably of Couesius. The breeding season is in June and July in this region."

Its range is from the Great Lakes, Labrador to Alaska and quite recently it was found in the mountains of West Virginia. In Maine it is found in the Androscoggin and Penobscot Rivers basins as well as in the Fish River and St. Francis River of the St. John River system.

Catostomus commersonii (Lacepede)
(Common sucker; fine-scaled sucker)

Body elongate, subterete, rather heavy forward, depth 4.3 to 5.3 in length, usually 4.5 to 5. Length 18 inches. Color olivaceous on back and sides, with more or less golden luster; belly whitish; vertical fins

with some dusky on rays, membranes paler, those of ventrals and pectorals orange, becoming deeper in spring males, which also have a faint rosy lateral band. Young brownish with blackish blotches and mottlings which are more or less confluent, sometimes forming an indistinct lateral band. Head rather stout, subconical, flattish above, its length 4 to 4.8; snout blunt, decurved, squarish at tip; mouth inferior, rather large, the lips strongly papillose, the upper rather thick with 3 or 4 rows of papillae; eye moderate. Dorsal fin with 11 to 13, usually 12, rays, its height scarcely, if at all, exceeding the length of the fin's base. Scales 10-11, 63-80, 9-11, crowded anteriorly and below; lateral line complete in adults, pores wanting on some scales in young.

This species is more likely to be abundant on bottoms with more or less rock and sand than on a completely muddy bottom and has a preference for clear, swift waters. This species reaches a length of 22 inches and a weight of 5 pounds.

The food of this sucker has not been carefully studied, but the strong, thick pharyngeal jaws, nearly twice as wide as high, and the relatively small number of pharyngeal teeth, the lower of which are very much thickened, with expanded crowns, constitute a crushing and grinding apparatus which strongly suggests a prevailing molluscan diet.

The species spawns in April or May, preferring for the purpose ripples or swift-flowing water to quiet pools.

Though bony, these fishes have a sweet, firm flaky flesh, and furnish a food of considerable importance in many parts of the country. They are

frequently salted for winter use, and are sometimes sold in markets under the name of "family whitefish." They are taken with seines, traps, and gill-nets, bite readily at the hook baited with worms or bits of crawfish, and are sometimes caught by boys in spring with snares fastened to poles.

Its range is from Quebec and the Great Lakes to Montana, Colorado and southward to Missouri and Georgia and west to Kansas. It occurs in practically all of the waters of Maine.

Cyprinidae
(The Minnows and the Carp.)

The various species of the family show considerable differences in respect to the kinds of food which they choose from the general supply offered to them. They are mainly carnivorous, on the whole, in this country, although we have found fishes and mollusks only rarely in the food of our native species. Insects and crustaceans, including Entomostraca, are their principal dependence, except for a few which eat largely of vegetation and a few others which feed almost wholly on the highly organic mud of the bottoms of ponds and streams.

Fishes so small as most of our minnows are, as a rule, in no need of a specially developed set of gill rakers, since the gill arches themselves are so small and the spaces between them so narrow that any object large enough to be useful for food is little likely to be carried out through the gills with the respiratory current. In the golden shiner however the gill rakers are considerably developed.

The intestine varies greatly in length, being longest in the mud-eating minnows and shortest in those dependent wholly or mainly on animal food. In a typical mud eater it may be from 5 to 9 times the length of the head and body, while in the more strictly insectivorous genera it is only 2/3 to 5/6 as long as the head and body taken together.

The native species are small and commercially insignificant except as they are used for bait and serve as a valuable food resource for other animals.

The top of the head in spring males, and often the fins and sides-- particularly the sides of the caudal peduncle -- are covered with small tubercles called pearl organs, and the fins and lower parts of the body are, in the breeding season, often highly colored with bright pigments, either red, satiny white, yellow to orange, or black. The young of the deeper-bodied species are much more slender than the adults and have much larger eyes. They may also show color markings not found in the adults of the same species, such as a caudal spot or a black lateral stripe.

The minnows, to some extent, act as a check on the increase of the aquatic insects, from which they draw a large part of their food supply; they make indirectly available as food for their own most destructive enemies, these aquatic insects and many terrestrial insects also which fall into the water and are greedily devoured by them and the mud, slime and algae gathered up from the bottom of the waters they inhabit. They rival the young of larger fishes by living continuously, to a great degree, on the Entomostraca and insect life which these fishes must have, at one period of their lives, in order to get their growth. They also offer a considerable means of subsistence to certain aquatic birds, such as kingfishers, and members of the heron family; and, through their contributions to the support of the best food fishes, they form an important link in the chain of agencies by which our waters are made productive in the interest of man. It is not too much to say that the number of game fishes which any waters can maintain is largely conditional upon its permanent stock of minnows.

Pimephales (fatheads).

Body robust or elongate, little compressed; head short and rounded; mouth small, inferior; upper jaw protractile; no barbel; teeth with oblique grinding surface, usually, but one of the teeth hooked; intestinal canal more than twice the length of body; peritoneum black; dorsal rays 7 or 8; anal rays 7; the first (rudimentary) dorsal ray in males evidently separated by membrane from the second, and not adnate to it as usually in minnows; scales rather small, 43 to 47 in lateral series; lateral line complete or imperfect; size small, 2 1/2 to 4 inches.

Pimephales anuli. (Kendall).
(Blunt-nosed Minnow).

Thus far known only from Maine (and not described by J. & E.) collected by Kendall & Gould.

The blunt-nosed minnow of Illinois (Pimephales notatus) is the most abundant and widely distributed of the minnows in that state. It is one of the mud-loving group, the alimentary canal being commonly packed from end to end with mud containing filamentous algae and miscellaneous vegetable debris. Occasionally fragments of insects or a specimen of the mud-loving Entomostraca may be found in the general mixture, and individual specimens have been reported to eat decayed fish in the aquarium. Its spawning season is from May 15 to June 15 in Central Illinois. The eggs are sometimes found on the under surface of various objects submerged in shallow water. They were found thruout June and a part of July, one of the parents being, as a rule, on guard about the

nest. The snout of the male in breeding season bears tubercles.

The Maine species has been recorded from Cross Lake Thoroughfare, Lunkasoos Lake and Salmon Lake.

*Kendall's description is as follows: Total length of type 68 mm., Head 3.8 in length; depth 3.8; scales 46,-13; Dorsal 9; anal 7. The head is blunt. Lateral line very incomplete; pores upon about 16 to 20 scales; scales about 26 before the dorsal, which is inserted midway between tip of snout and base of caudal fin. Peritoneum black; intestine elongate, about 1.5 the length of the body. Color when fresh, light olive on back, with white sides and belly; head dark on top; an indistinct lateral stripe along axis of body, and a dark bar across base of caudal; a dark olive line from occiput splitting and passing each side of dorsal fin, re-uniting behind and continuing to upper base of caudal; upper part of head snout and opercles dusky; a black spot in front of dorsal and a somewhat indistinct one similarly situated behind; other fins all pale.

* Fish Com. Bul. No. 486 Vol. 22, 1902, p.p. 360-61.

Leuciscus (Dace).

Body oblong, compressed or robust, covered with moderate or small scales; Lateral line decurved, complete, or variously imperfect. Mouth usually large and terminal, the lips normal, without barbel. Anal basis short or more or less elongate. Dorsal fin posterior, usually behind ventrals. Intestinal canal short. Size generally large, some species very small. A very large group, one of the largest current genera in ichthyology, represented by numerous species in the rivers of Europe, Asia and North America. Most of our species have been poorly defined. As the species are extremely variable in form, the number of nominal ones has been very greatly multiplied. Much larger series of each form are necessary before the species can be properly discriminated. Individual irregularities in dentition are common in this genus.

Leuciscus carletoni. (Kendall).
(Chub-minnow: Carletons Chub-minnow)

This species is known only in Maine and is not described by Jordan and Evermann. It has been reported only from Fish River and Penobscot River basins.

Kendall's description is as follows: Head 4.35 in length; depth 4.83; Dorsal rays 8; anal 8; scales 12-73-18. Body elongate, rounded, back little elevated; head blunt, the profile moderately steep; mouth terminal, oblique; maxillary with small barbel just above its extremity; lateral line slightly decurved, nearly continuous, absent only on last scales; Scales rather small. Dorsal fin inserted behind front of ventral.

Coloration above dusky olive, somewhat speckled with brown; an irregular dusky stripe along the lateral line to base of caudal, ending in a small black spot; below lateral line creamy white with brownish spots on side; dorsal and pectoral dusky; other fins pale. The male sometimes becomes brilliantly red along the side of the abdomen from behind the pectoral fin to the lower base of the caudal. The color persists to some extent on individuals until fall.
Fish Commission Bul. No. 486, V. 22; 1902, p. 357-8-9.

Phoxinus neogaeus.(Cope).
(Bronze minnow).

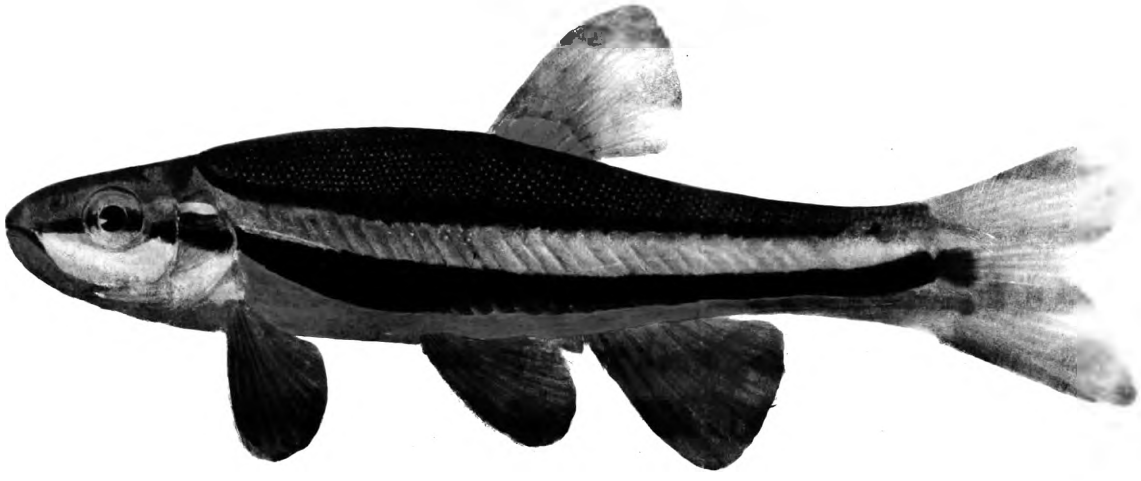
Head 4, depth 4 1/4; eye moderate; D.8; A.8, scales 18-80-10. Body short and thick; little compressed, the back little elevated; Head very large and broad, the muzzle blunt. Mouth small, quite oblique, the lower jaw scarcely projecting; maxillary reaching to beyond front of orbit; upper lip on level of middle of pupil. Fins moderate; dorsal well backward, much nearer caudal than snout, somewhat behind ventrals; pectorals long 1 1/5 in head. Scales very small, almost embedded in skin, covering the body evenly. Lateral line decurved, very short, not extending to ventrals. Back and belly scaly. Color pale or dark; back plain dusky; a black band through snout and eye to caudal; above this a pale band; below this abruptly white; belly and lower fins crimson in spring males; pectorals dusky; no caudal spot. Length 3 inches.

"It feeds upon small insects, eggs, larvae, worms and vegetable matter. It makes a good bait and will readily take a small hook baited

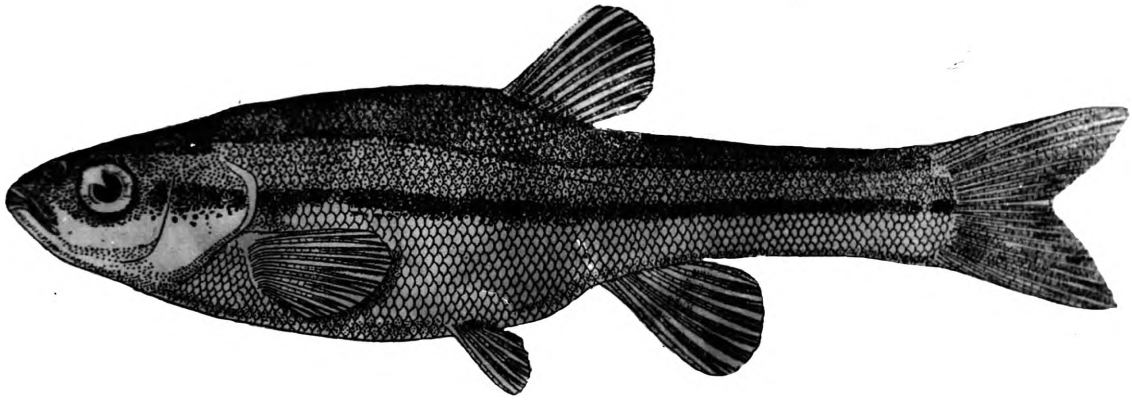
with worm. Nothing regarding its breeding habits was observed, but it probably spawns in the spring or early summer." (Rangeley Lakes, Maine: Fishes, Angling and Fish Culture)

It exhibits a wide hiatus in its range, previous to its discovery in Maine and New Brunswick being known only from a few specimens from Livingston County, Michigan, Baraboo River, Wisconsin, White River, Arkansas, and the Black Hills of South Dakota.

It is reported in Maine in the Androscoggin, Penobscot, Allagash, and Fish River basins.



RED-BELLIED DACE, *Chrosomus erythrogaster*



BRONZE MINNOW, *Phoxinus neogaeus*

Chrosomus erythrogaster.(Raf.)
(Red-bellied dace).

The minute scales, 77 to 91, in the lateral line, and the two longitudinal stripes of dark color upon the sides will readily distinguish this species from the other minnows; Length 2 to 3 inches; body oblong, moderately compressed, tapering about equally each way from middle of body; depth 4.4 to 4.9 in length; Color above brownish olive, with a broad vertebral streak of dusky and dark spots forming an indistinct row on upper part of each side; sides marked with two black stripes (faint in females), the upper and narrower one extending from upper corner of gill-cleft nearly straight backward to base of caudal, sometimes breaking up into spots or oblique bars on caudal peduncle; the lower stripe broader, extending from snout through eye and along lower portions of side to end of caudal peduncle, followed by a black spot at base of caudal rays; the interspace between lateral bands a bright silvery or satiny cream tinged with brassy to crimson in males; belly white, overlaid with silvery; females much more obscurely marked than males which in spring coloration have the belly, breast, and chin bright scarlet, and the fins a bright lemon-yellow, the dorsal with a large blotch of bright scarlet at its base and the body everywhere minutely tuberculate. Head rather pointed 4 to 4.2 in length; nose short, pointed, longer than the small eye; mouth moderate, terminal oblique, the tip of upper lip nearly at level of middle of pupil; maxillary reaching but slightly past anterior nostril-opening; jaws about equal. Intestine 2.4 to 3.5 times length of head and body; peritoneum black. Dorsal fin with rays usually 7, in

occasional instances 6, placed behind ventrals and about equidistant between snout and base of caudal; anal rays 7 or 8, usually eight; ventrals reaching vent. Scales very small, 17-20, 77-91, 9-12, of uniform size everywhere, the exposed surfaces scarcely deeper than long; lateral line incomplete, there being usually no pores present on posterior half of body; scales before dorsal 35 or 40.

It is commonly found in small clear streams. Its food is evidently obtained by nibbling or sucking the surface slime from stones or other objects on the bottom. It consists mainly of mud containing algae with an occasional trace of Entomostraca.

The breeding season falls in May and June, at which time the colors of the male reach their most gorgeous development. While not especially hardy, this species lives well in the aquarium.

Its range is from Maine to Alabama, although not recorded between northern New York and Maine; west to Nebraska and Dakota. In Maine it is not very widely distributed, being recorded only from the Royals, Kennebec, Penobscot and Fish River basins, and Mt. Desert.

Semotilus.
(Fall-fishes)

Body robust; head large; mouth terminal, wide, the upper jaw protractile; a small barbel on the maxillary just above its extremity, not at the tip as in most other American minnows. (In young examples the barbel cannot always be found.) Intestinal canal short; scales moderate; Lateral line continuous; Dorsal more or less posterior to ventrals; Species of large size, the largest of the chubs found in Eastern America differing from Leuciscus in the presence of a maxillary barbel.

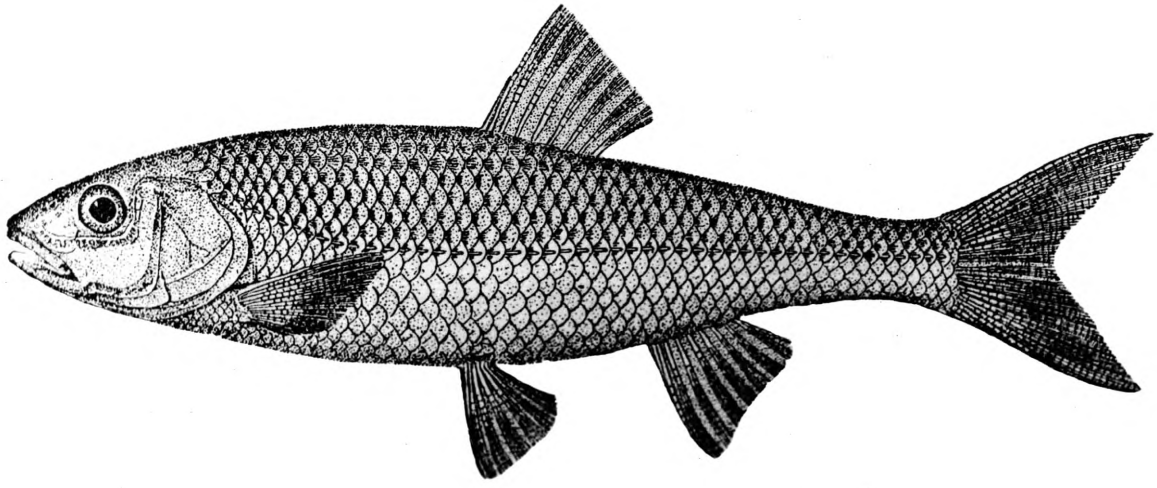
Semotilus atromaculatus (Mitchell).
(Horned dace; creek chub).

Length usually 6 to 8 inches, sometimes reaching a length of a foot; body rather elongate, but robust, heavy forward, the back gently arched in front of the dorsal fin; depth 4.1 to 4.6 in length; caudal peduncle shorter than head. Color dusky bluish-olive above; tinges of light purplish on sides as far down as lateral line; a faint plumbeous lateral band, somewhat more distinct towards end of caudal peduncle; a faint vertebral streak and a dark bar behind opercle; sides below lateral line greenish gray to silvery; belly silvery; dorsal fin with distinct black blotch at base, between first and third rays; in breeding males there is sometimes a broad but indistinct transverse bar of dusky color crossing the fin about midway; other fins plain, or at most, with slight traces of dusky in spring males. Head large, everywhere convex, broadly rounded above, 3.5 to 3.9 in length; nose long,

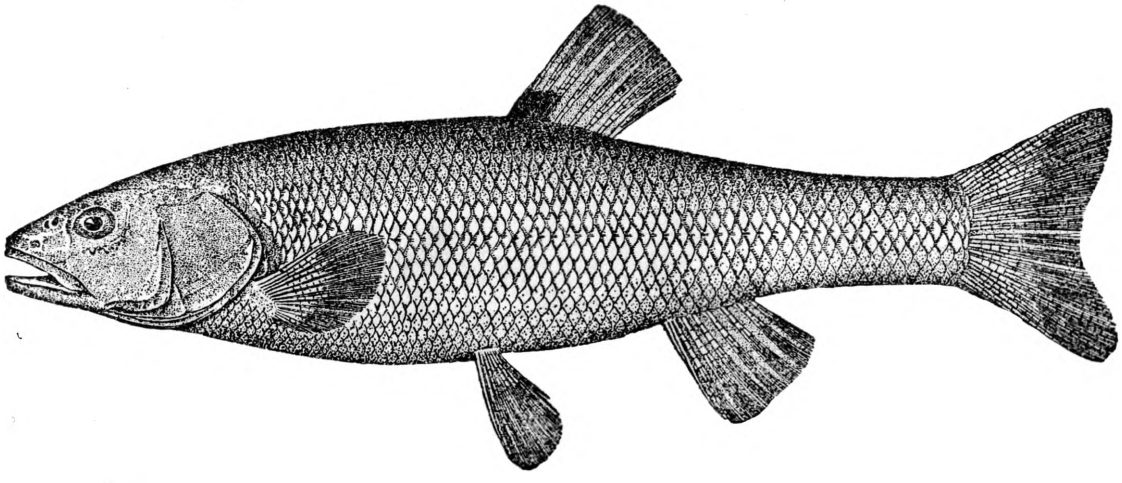
broadly and bluntly rounded; mouth very large, terminal oblique, tip of upper lip at level of lower margin of pupil; jaws about equal; intestine .9 to 1.1 times length of head and body; peritoneum pale, a very little dusky forward. Dorsal fin with 8 rays, situated behind ventrals equidistant between front of eye and base of caudal; anal rays 8; pectorals short, reaching 1/2 to 2/3 to ventrals; ventrals short of vent in adults. Scales 10 or 11, rarely 9, 55 to 69, 5 to 7, considerably crowded in predorsal and scapula regions, about 35 rows before dorsal fin, lateral line complete with a strong downward curve in front of ventrals

This is essentially a creek species. It is an active swimmer and exceedingly voracious, and with an unusually varied diet for a minnow, including considerable quantities of vegetable food on the one hand, and small fishes on the other. This species is reported by Jordan to reach the length of a foot and to be excellent bait, when of the proper size, for bass, wall-eyed pike, and pickerel. It is a very gamey minnow, always ready to bite at a grasshopper, and will even rise to the fly. It thrives well in the aquarium and with good treatment soon becomes so tame as to feed from the hand. It is found chiefly in small brooks where it is often the largest and most voracious inhabitant.

Its range is from Maine, western Massachusetts to southern Missouri, Wyoming and Canada. It is found in many of the waters of Maine but is not reported from the Presumscot, St. Croix, Aroostook & St. Francis River basins.



CHUB, Semotilus bullaris



BROOK CHUB, Semotilus atromaculatus

Semotilus bullaris* (Raf.)
(Chub; dace, silver chub)

Head 4; depth 4. Dorsal 8; anal 8; scales 8-45-4. Body oblong, robust, little compressed. Head large, convex, the snout bluntly conic; mouth large, terminal somewhat oblique, the lower jaw included; premaxillary below the level of the eye, the maxillary barely reaching front of orbit. Eye moderate, rather high up and anterior. Barbel shorter than pupil, not evident in young specimens. Scales large, 22 in front of dorsal, not much crowded anteriorly. Dorsal fin slightly behind middle of body, just behind ventrals. Fins moderate; coloration brilliant; steel-blue above; sides and belly silvery; males in spring with belly and lower fins rosy or crimson; no spots on fins; Length 18 inches.

It is found in clear, swift streams, rock pools, below cataracts, and in clear lakes. It is much the largest of the eastern "Cyprinidae," ranking with the western and some European forms. "The chub is a soft fish and tastes like brown paper, salted". Thoreau.

Kendall states (in "Fishes and Fishing in Sunapee Lake") that "Although the chub has toothless jaws and tongue, it is carnivorous, subsisting upon insects and other fishes to a large extent. The writer has seen chubs feeding upon and has found them gorged with young pickerel 3 or 4 inches long. The chub is more or less destructive to other fishes and is, like the sucker, a spawn eater. The chub is very interesting in the

* Semotilus corporalis (Jordan and Evermann)

curious habit of the male in breeding season of heaping up pebbles, which it conveys in its mouth to the spot chosen for the "nest" in which the female deposits her eggs. The heap is often of remarkable size, especially in waters of the far north, a cartload of pebbles comprising it. A chub's nest fully 5 feet in diameter and a foot high was found at the upper end of Pike Brook deadwater."

Although one of the commonest species in New England, it has not a very wide range. It is found east of the Alleghanies as far south as the James River. It is widely distributed in Maine and has been reported from all the river basins except the Aroostook.

Abramis crysoleucas.(Mitchell).
(Golden shiner. Roach; Bream)

The small pointed head, greatly compressed form, strongly decurved lateral line, and the sharp keel on the belly behind the ventral fins will as a rule distinguish this species from others of its family. Length 6 to 8 inches; body moderately elongate in young, in adults becoming very deep and strongly compressed; depth 3 to 3.6 in length; caudal peduncle short; color a clear dark greenish olive above, becoming steel-blue in some lights; sides silver with bright golden reflections; a half-diamond shaped or triangular spot of dark color more or less evident at base of exposed portion of each scale; dorsal and anal fins tipped with dusky; lower fins yellow, the ventrals bright orange at tips in breeding individuals of both sexes; young with a faint vertebral streak and a distinct dark band along sides. Head small, subconic, flattened on the sides, 4 to 4.5 in length; eye within the anterior half of head, and rather low, about as near chin as crown; nose sharply pointed, appreciably longer than eye; mouth rather small, terminal oblique, tip of upper lip even with top of pupil; maxillary not reaching past anterior nostril; jaws about equal. Intestine from 1 to 1.8 times length of head and body; peritoneum lightly speckled with dusky. Dorsal fin with 8 rays, set distinctly behind ventrals, its first ray about equidistant between upper corner of gill-opening and base of caudal; anal rays 11 to 14; pectorals reaching about 2/3 to ventrals; ventrals falling short of vent in adults. Scales 9 to 11, 45 to 52, 3; lateral line complete, broadly and deeply decurved, and often flexuose from back of

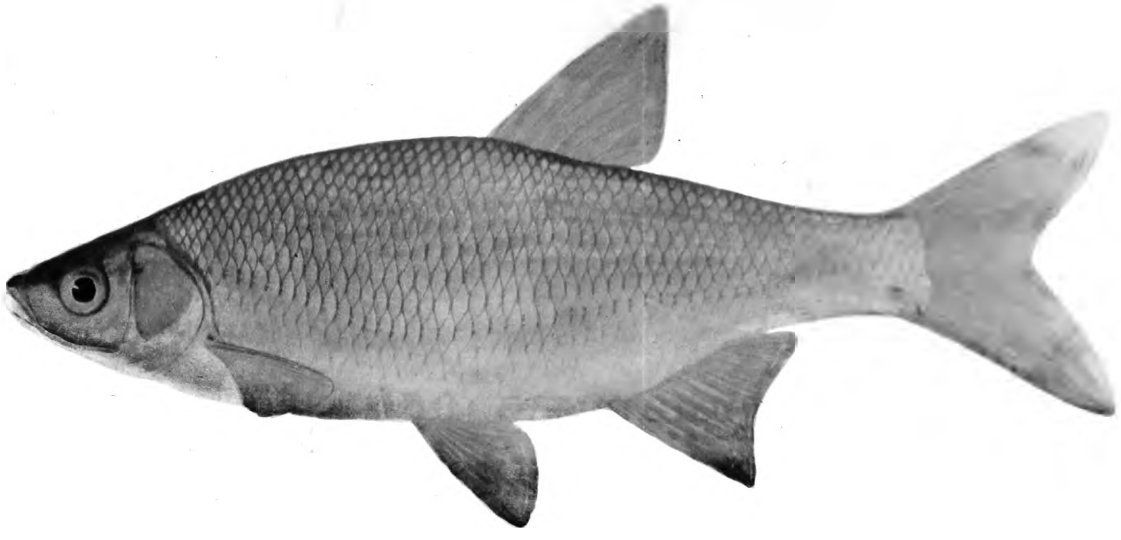
opercle to a point about midway of caudal peduncle its distance from the back in the middle of the body 2 1/2 times the interval below.

It prefers slow streams and grassy ponds, and is sometimes found in large numbers in the muddiest and most uninviting holes. It has an efficient equipment of alimentary structures and a correspondingly wide range of food resources. Its intestine is rather long -- one and a third times the length of the head and body together; the gill rakers are long fine and numerous; and the pharyngeal teeth are provided both with terminal hooks and grinding surfaces. Its food varies consequently, according to situation, from a mere mass of mud, to mollusks, insects, Entomostraca, and vegetable substances. When mollusks are abundant, it sometimes feeds on nothing else; and in ponds containing many minute Crustacea, these may be its sole food. Insects may be eaten by some, algae by others.

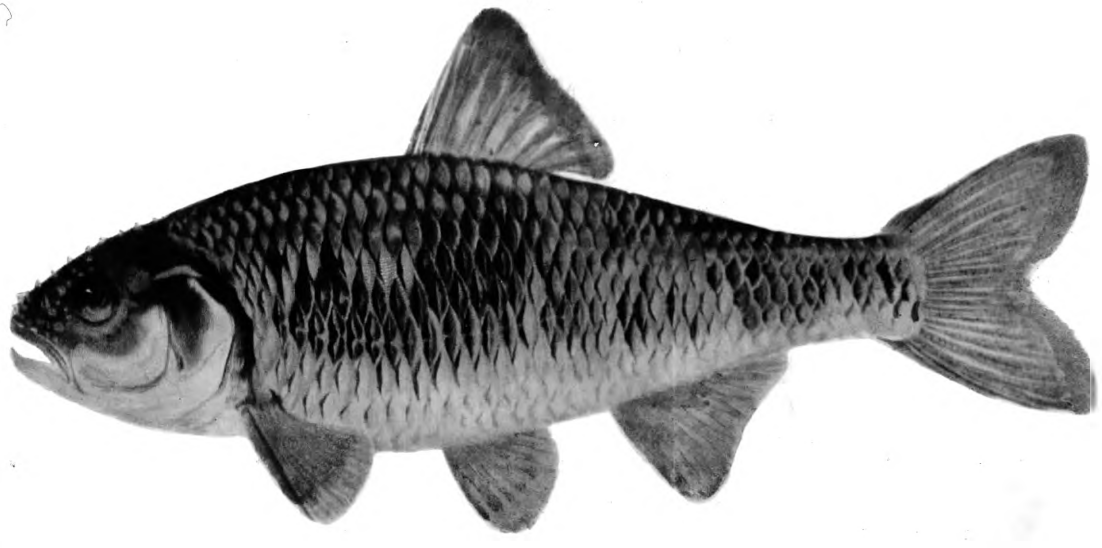
The golden shiner is said to be an excellent pan-fish, if of sufficient size. It is active all winter and can be caught through the ice. It lives well in the aquarium and makes a good bait for black bass.

Spawning females, with eggs running from the vent, have been taken in May and occasionally as late as July 30. The eggs are extremely adhesive and contain no oil globule. The males average smaller in size than the females, and have the back somewhat more swollen at the nape. Their sides are rough with minute tubercles, but the head and snout are not tuberculate.

Its range is from Nova Scotia to Dakota, Florida and Texas. It is abundant in Maine, being reported from the Presumscot, Androscoggin, Kennebec, Penobscot, St. Croix, and Fish River Basins.



GOLDEN SHINER, *Abramis crysoleucas*



COMMON SHINER, *Notropis cornutus*

Notropis.

Body oblong or elongate, more or less compressed. Mouth normal, mostly terminal and oblique; No barbels. Scales large, often closely imbricated, those before the dorsal rarely very small. Lateral line complete or nearly so, usually decurved. Dorsal fin inserted above or more usually behind the ventrals; anal fin short or somewhat elongate. Abdomen rounded, never sharp edged. Coloration more or less silvery, often brilliant, the males in spring usually with red or white pigment and the head with small tubercles.

They are a very large group of fishes, especially characteristic of the fresh waters of Eastern U. S. They are feeble fishes of small size, none of them of value as food for man, but of great importance as food for the larger predatory fishes. The species are highly variable, readily affected by surrounding conditions while the really distinctive characters are very few. The identification of species is difficult and in the case of young specimens often impossible.

Notropis bifrenatus.(Cope).
(Bridle minnow)

Head 4 1/5; depth 4 1/5 D.8 A.7 scales 5-36-3. Body rather slender, the caudal peduncle somewhat contracted. Head moderate, the muzzle very obtuse; mouth oblique, the jaws about equal; upper lip opposite lower pupil. Eye large, longer than snout. Lateral line developed for a very short distance. 13 scales before dorsal. Straw colored, the scales brown-edged above; a shining black band from snout through eye to caudal; this includes the edge of the lower jaw; an orange band above this on the

snout; regions below the black band silvery. Length 1 1/2 to 2 inches.

This is a small but handsomely colored species. In Maine it is known only from the Sebago Lake or Presumscot River basin, but is otherwise recorded from Massachusetts to Maryland.

Notropis kendalli (Evermann & Cockerell).
(Kendalls minnow)

Known only from Maine and not described by Jordan and Evermann. It is reported only from Hay Brook and Bill Fish Brook of Penobscot River system and Smith Brook and Cross Lake Thorofare of the Fish River basin.

Notropis cornutus. (Mit).
(Redfin; buckfish, common shiner)

This species is distinguished especially by the great depth of the exposed portions of scales and (in spring males) by the brilliant and more or less mottled salmon-pink coloration. Length 5 to 8 inches; body elongate in young; adults shorter and much compressed, the sides nearly vertical; depth 3.3 to 4.4 in length; anterior dorsal region gibbous and rather swollen in adult males; caudal peduncle rather deep. Color of midsummer males olivaceous above with steel-blue luster; belly and lower part of sides silvery; a broad dark vertebral streak and a faint plumbeous lateral band, showing as gilt when seen through the water; scales above lateral line thickly specked with dusky, with narrow edges of darker; scales along middle of each side partly with the most of the exposed surface unspecked bright silvery with dusky bases, and partly wholly dusky, giving rise to a mottled appearance which is most accentuated

in the breeding season; dorsal and caudal fins somewhat dusky, other fins plain; coloration of spring males very brilliant, the upper parts greenish and the sides a rich salmon pink over silvery, with mottlings of dusky emerald; females and young are plain olivaceous above and silvery below. Head 3.8 to 4.2 in length, rather large and heavy, compressed, rounded between the eyes, the muzzle bluntish; eye rather small; nose much longer than eye in adults; mouth moderately large and oblique, the tip of the upper lip usually very little above level of lower margin of orbit; lower jaw slightly shorter than upper. Intestine .9 to 1.5 times length of head and body; peritoneum dusky to solid brown. Dorsal fin with 8 rays, set usually a little in advance of the ventrals and closer to muzzle than base of caudal; anal rays 9 or 10, usually 9; ventrals usually not reaching vent. Scales 6, rarely 7, 37-40,3, rows before dorsal 16 to 25; always much deeper than long in the flanks, becoming exceedingly so in adults; longitudinal rows with an appearance of "running out" behind dorsal fin; lateral line complete, decurved anteriorly.

This common, large and well known minnow is found especially in creeks and the smaller rivers. It also shows a marked preference for clear waters. The food consists of insects, vegetable matter, especially algae, and less often fishes and crustaceans.

Its spawning begins about May 1 and continues to the last of June. The minnow takes a worm or grasshopper readily and is one of the fishes most likely to be found on a boy's string. Although it sometimes grows to a length of eight inches, it is usually too small to be of importance as a

pan fish.

Its range is the entire region east of Rocky Mountains excepting the So. Atlantic States and Texas, almost everywhere the most abundant fish in small streams.

It is very common in Maine, being found in most of our waters. It has not been reported from the Aroostook river basin. It is commonly used in Maine as bait.

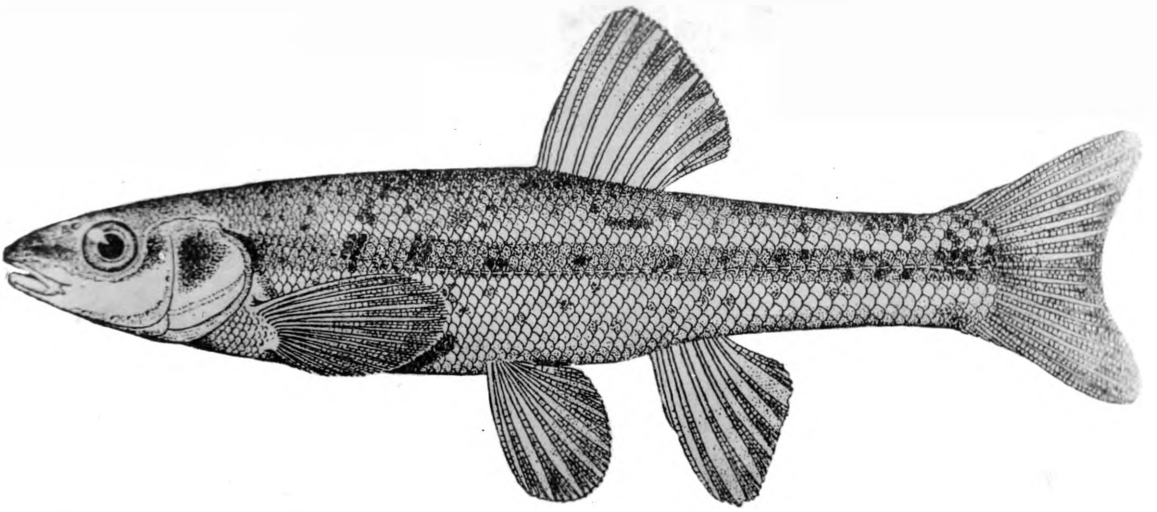
Rhinichthys atronasus.(Mit.)
(Black-nosed dace)

Length 2 3/4 inches; body moderately elongate, very little compressed; depth 4.5 to 5 in length; caudal peduncle rather short and deep, less than head. Color dusky to blackish above, the back and sides variously mottled with darker; a black band along sides, through eye to end of snout, below which is a paler streak; belly silvery; a distinct black blotch at base of dorsal behind; dorsal otherwise and all fins plain; spring males with lower fins and often almost entire body more or less blood-red, this color becoming obsolescent by midsummer. Head pyramidal; a little wider than deep, rather broad and flattish above; length of hear 3.6 to 4.2 in head and body; eye small; nose long and projecting, but not decurved, both nostrils lying well in upper half of head. Mouth rather small and subterminal, slightly oblique; a minute maxillary barbel; low jaw included. Peritoneum silvery except high up where it is dusky. Dorsal fin with 8 rays, set distinctly behind ventral; pectorals about 2/3 to ventrals; ventrals past base of anal in adult males. Scales 9 to 11, 62-71.8 to 10; lateral line complete, little decurved.

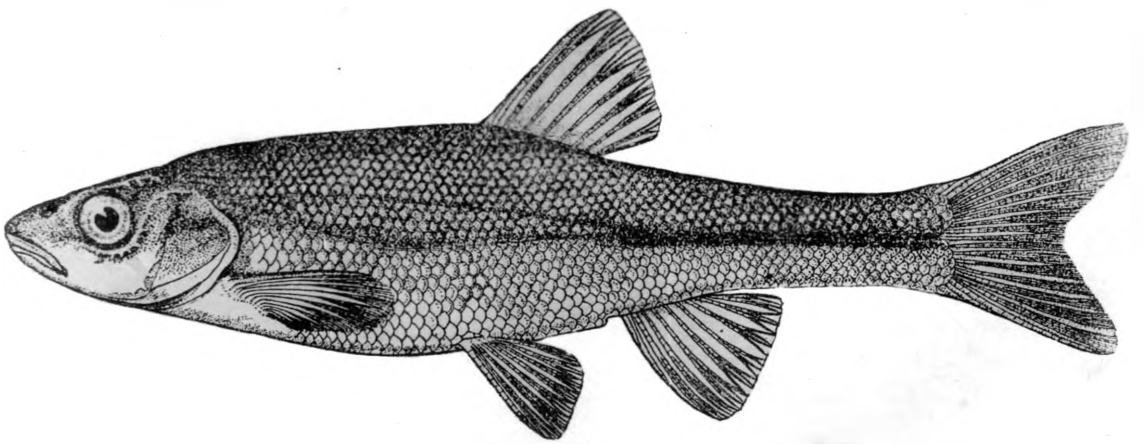
Breeding males were taken about Ottawa in June. It has been seen to spawn in shallow running water, piling pebbles up about the nest after the eggs are deposited.

Spring males have the front of the head and occipital regions finely tuberculate.

The range is from New Brunswick to Minnesota, Virginia and northern Alabama. It is common in Maine, being reported from the Presumscot, Royals, Androscoggin, Kennebec, Penobscot, St. Croix and Fish River basins.



BLACKNOSE DACE, *Rhinichthys atronasus*



DUSKY CHUB, *Couesius plumbeus*

Couesius plumbeus.(Agassiz)

(Gray chub minnow; Dace; Dusky chub)

Head 4 1/2; depth 4 1/2; Dorsal .8; Anal .8; scales 11-60 to 70-7. Form of Semotilus atromaculatus, but more elongate and less compressed. Head flattish above, the snout broad, somewhat projecting over the large, oblique mouth; maxillary reaching front of eye; Barbel evident. Eye large, as long as snout. Scales small, crowded forwards, those on back smaller. Dorsal beginning over last ray of ventrals. Height of dorsal fin 1 to 1 1/3 in head; free margin of fin concave, the anterior rays produced and extending beyond the others when the fin is depressed. Form of anal similar to that of dorsal. Dusky above; sides somewhat silvery; an obscure dusky band through eye around snout; fins plain, Length 6 inches. Streams and lakes from Lake Superior east to the Adirondack region, and New Brunswick: not very common, except northward. In Maine it is found in the Presumscot, Royals, Androscoggin, Kennebec, Penobscot, and St. John River basins.

Family anguillidae.

(True eels)

Body serpentine, or eel shaped, covered with fine scales which are deeply imbedded in the skin; head naked; lateral line present; ventral fins absent; no spines in fins; dorsal and anal continuous with caudal around tail; operculum small, concealed beneath skin; mouth terminal; jaws about equal; premaxillaries absent; maxillaries lateral; maxillary, mandible and romer with cardiform teeth; air-bladder with open duct; young passing through a larval stage, the ribbon shaped larva being known as "Leptocephalus" (a name first used to designate these forms as a distinct genus of fish.

Fresh and brackish waters of most parts of the world, but not found on the Pacific Coast of North America or in islands of the Pacific.

Anguilla chrysypa. (Raf.)

(American eel; fresh-water eel)

Length 3 to 4 feet, weight 5 to 8 pounds; body serpentine, subcylindrical anteriorly, compressed behind; depth in length 12 to 17. Color variable, usually nearly plain greenish brown, often more or less tinged with yellowish; belly paler, greenish gray. Head 7 or 8 in length; a single pair of short nasal barbels; mouth wide, maxillary past orbit, lips thin and lower jaw projecting; gill-openings confined to the sides of the neck below top of pectoral basis. Dorsal fin inserted about head's length in front of anal; dorso-caudal with about 60 rays to tip of tail; pectorals very short; no ventrals. Scales minute, oblong, slender, and deeply imbedded, the oblique rows taking a zigzag direction; lateral line developed, nearly straight.

Eels prefer deep water with mud bottom. They are often found in the mouths of shallow sloughs at night, and in such places may be taken along with bullheads on trot-lines. They are powerful and rapid swimmers, and can travel rapidly over the ground, like snakes. They have been known to come out of the water into damp meadows, where they are sometimes found hiding under stones near springs.

They are among the most voracious of all carnivorous fishes, but are chiefly scavengers in their feeding habits, eating all manner of refuse, preferring, however, dead fish or other animal matter. They sometimes devour fishes caught in gill-nets, and on the Atlantic Coast frequently mutilate shad, caught in the net, to get at their roe. It

frequently happens that the greater part of a gill-net catch may consist, when it is removed, simply of the heads and backbones of fishes, the remainder having been devoured by myriads of eels. They are nocturnal feeders, "poking their noses into every imaginable hole in their search for food."

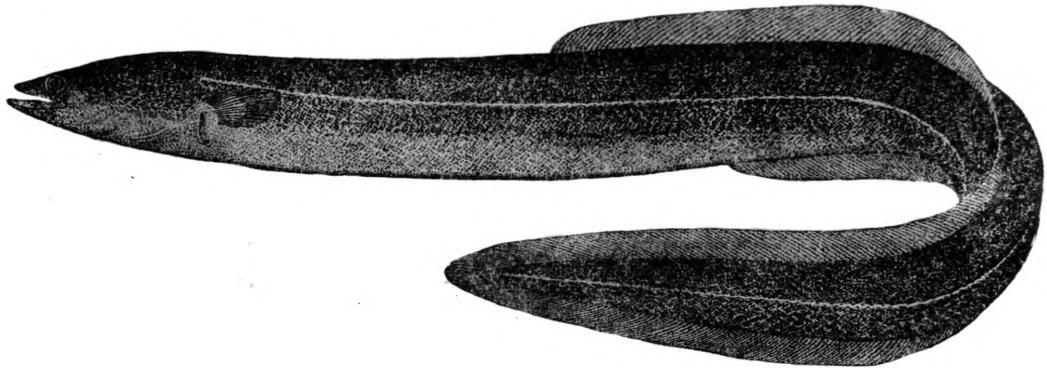
The flesh of the eel is highly esteemed by many. In the Great Lakes region and in the East eels are often salted and smoked. They are also put up in tins with jellies or a spiced sauce of vinegar. Their skins are used in England for binding books and making whips. Eels are caught in traps and eel-pots and on set-lines, and sometimes also with seines.

The mode of reproduction and the development of their young were unsolved riddles from the time of Aristotle to near the end of the nineteenth century, but all essential facts in the life history of the species are now well understood. The principal difficulty arose from the fact that the eel, although a fresh-water fish during the greater part of its life, migrates to the sea to propagate, spawning in salt water, usually on muddy banks off the mouths of rivers. The young develop within two or three months, but they are so unlike the adults that they were not recognized as belonging even to the same genus. Spawning occurs in fall, and at the beginning of the second spring the young find their way to the mouths of rivers, which they ascend in considerable numbers, remaining in fresh water until full grown, when they return to the sea. During the migration, eels like salmon and

shad, do not take any food. Their sexual organs do not mature until they have been some weeks in salt water. After spawning, both sexes die, neither males nor females ever returning to fresh water the second time. The eel is remarkably prolific, a single female 32 inches long having been estimated to produce 10,700,000 eggs.

They are found in salt and fresh water from the St. Lawrence River to the Gulf of Mexico and the West Indies; they are abundant thruout Mississippi Valley, but are not found in the Pacific.

They are very common in Maine, but are not reported from the Union and St. John River basins.



EEL, *Anguilla rostrata*

Salmonidae.

They are best adapted of all fishes for artificial culture. The eggs can be transported long distances in ice without injury, making it possible to introduce American and British forms into some of the temperate regions of the southern hemisphere.

Salmo. (Salmon and trout)

Body elongate, somewhat compressed. Mouth large, jaws, palatines and tongue toothed. Scales large or small, 110 to 200 in a longitudinal series. Dorsal and anal fins short, usually of 10 to 12 rays each: caudal fin truncate, emarginate or forked, its peduncle comparatively stout. Sexual peculiarities variously developed: the males in typical species with the jaws prolonged and the front teeth enlarged, the lower jaw being hooked upward at the end and the upper jaw emarginate or perforate. In the larger and migratory species these peculiarities are most marked.

There is no other group of fishes which offers so many difficulties to the ichthyologist with regard to the distinction of the species, as well as to certain points in their life history as the trout. The almost infinite variations of these fishes are dependent on age, sex, and sexual development, food, and the properties of the water. The coloration is, first of all, subject to variation, and consequently this character but rarely assists in distinguishing a species, there being not one which would show in all stages the same kind of

coloration. The young in all the species of this genus are barred, and this is so constantly the case that it may be used as a generic or even family character probably peculiar to Coregonus as well as to Salmo. The number of bars is quite constant, but the migratory trout have two (or even three) more than the river trout. When the Salmones have passed this "parr" state the coloration becomes much diversified. The males, especially during and immediately after the spawning, are more intensely colored and variegated than the females, specimens not mature retaining a brighter silvery color, and being more similar to the female fish. Food appears to have less influence on the coloration of the outer parts than on that of the flesh; thus, the more variegated specimens are frequently out of condition, whilst well fed individuals, with pinkish flesh, are of more uniform though bright colors. The water has a marked influence on the colors. Trout with intense ocellated spots are generally found in clear, rapid rivers and in alpine pools; in the large lakes, with pebbly bottoms, the fish are bright silvery, and the ocellated spots are mixed with or replaced by x-shaped black spots; in dark holes, or lakes with peaty bottoms, they often assume an almost uniform blackish coloration. The brackish or salt water has the effect of giving them a bright silvery coat, without or with few spots, none of them ocellated. With regard to size, the various species do not present an equal amount of variation. Size appears to depend upon the abundance of the food

and the extent of the water. Thus, the migratory species do not appear to vary considerably in size, because they find the same conditions in all the localities inhabited by them. A widely-spread species, however, (like Salmo mykiss) when it inhabits a small mountain pool, with scanty food, never attains a weight of 8 ounces, while in a large lake or river, where it finds an abundance of food, it attains to a weight of 14 or 16 pounds. Such large river trout are frequently named or described as Salmon trout, Bull trout, Steelheads, etc.

The proportion of the various parts of the body to one another vary exceedingly, in the same species, with age, sex, and condition. The fins vary to a certain degree. The variation in the number of rays in any one genus is inconsiderable. The proportion of the height of the dorsal and anal fins to their length is a rather uncertain character. In most of the species the fin rays are longer during the stages of growth and development. The caudal fin especially undergoes changes with age. Young specimens of all species have this fin more or less deeply excised. The individuals of the same species do not attain to maturity at the same size.

Finally, to complete the enumeration of these variable characters, we must mention that in old males, during and after the spawning season, the skin on the back becomes thickened and spongy, so that the scales are quite invisible or hidden in the skin.

Coregonus (Whitefishes).

Body oblong or elongate, compressed. Head more or less conic, compressed, the snout more or less projecting beyond the lower jaw. Mouth small, the maxillary short, not extending beyond the orbit, with well developed supplemental bone. Teeth extremely minute if present. Scales moderate, thin cycloid, rather firm. Dorsal fin moderate; caudal fin deeply forked, anal fin somewhat elongate; ventrals well developed. Air bladder very large. Stomach horse-shoe-shaped with many (about 100) pyloric caeca. Ova small.

Most of the species spawn in late fall or winter near the shore, at other seasons often frequenting considerable depth.

The species are highly valued for food, the flesh being generally pale and of fine flavor.

The coloration is very uniform, bluish olivaceous above; the sides and below silvery.

Coregonus quadrilateralis.(Richardson)

(Pilot-fish; Menominee whitefish: Shad-Waiter Round Whitefish)

Head 5; depth 4 3/4 Dorsal.11; Anal.10 scales 9-80 to 90-8. Body elongate, not elevated nor much compressed, the back rather broad, the form more terete than in any of the other species. Mouth very small and narrow, inferior, the broad maxillary not reaching to opposite the eye. Head long, the snout compressed and bluntly pointed, its tip not below level of eye; profile not strongly decurved. Mandible originated under

middle of eye. Adipose fin small. Gill rakers short and stoutish. Color dark bluish above, silvery below. Length a foot or more.

This species spends most of its time, as a rule, in the deeper, cooler parts of the lakes which it inhabits, coming towards the shores and sometimes entering streams in October and November as the spawning season approaches. In many lakes there is a migration movement from deep to shallow water in early summer also. The whitefish spawns during October, November, and December in depths varying from eight to fifteen fathoms, beginning, it is said, when the water reaches about 40° F. It is most active on its spawning grounds in the evening and at night, each female depositing several hundred eggs at a time and the total number averaging about ten thousand for each pound of her weight.

The young usually appear in March and April.

Its range is from the Lakes of New England and the Great Lakes northwestward to Alaska, and as far south as the Yukon River. In Maine it is reported only from the Kennebec and St. John River.

Coregonus labradoricus.(Rich.)

Sault Whitefish; Musquaw R. white fish.

Head 5; depth 3 1/5 to 4; eye large. Dorsal 11 or 12; Anal 11 or 12, scales 10-71 to 76-9. Gill rakers short; Body rather elongate, compressed, the back not elevated. Head rather small and slender, compressed. Mouth rather small, the lower jaw short, the snout projecting; the maxillary

reaching front of pupil; maxillary bones broad, rather short. Mandible reaching middle of eye. Tongue with about three series of small teeth. Dorsal fin high in front, the last rays short. Bluish black above; silvery below; scales with dark punctulations on the edges; fins all dusky, pectorals and ventrals pale at base. Length 21 inches.

It is generally abundant in cold, clear lakes and large streams; A species of good flavor, valued as food.It is a variable species, perhaps containing several recognizable subspecies.

Kendall states (in Fishes of Connecticut Lakes) that Coregonus labradoricus "has been caught in Moosehead Lake by deep fishing with bait and once in a while on a fly: in the Fish River Eagle Lakes of Aroostook County it is taken by trolling with small spoon and hooks baited with worms, and on small artificial flies. To angle successfully for whitefish a light flexible rod and small gauze-winged flies are desirable. The fish is gamy when hooked and will out-rush, out-leap, out-twist, or out-maneuver any other fish of its size. This sport is rendered still more exciting from the care that must be exercised to retain the fish, since the small hook that must be used is easily torn from the tender mouth."

The fish is recorded from Winnipeg and Great Lakes region and northeastward. In Maine it is reported from the Presumscot, Kennebec, Union and St. John River basins.

Coregonus stanleyi. (Kendall)

Little whitefish; Stanley's whitefish.

Thus far recognized only from Maine. According to Dr. Bean this species occurs in Chateaugay Lake, New York. This species is not described by Jordan and Evermann. It is reported only from the Eagle Lakes and Cross Lake Thorofare of the St. John River system.

Following is Kendall's description. Head 4.52 in length; depth 4.33; dorsal 10; anal 14; scales 10-82-7. Body fusiform, not very deep, somewhat compressed; back gradually curving from tip of snout to front of dorsal; head rather sharply rounded, not truncate as in Caregonus clupeiformis; maxillary reaching front of eye; dorsal inserted in front of ventral nearer snout than base of caudal, its anterior rays extending considerably beyond tips of posterior rays, when depressed; caudal deeply forked, the peduncle slender, compressed. Body and head covered with white tubercles, small and dot-like on the back and belly, 1 and 2 on each scale, large and more prominent on the head and sides of body, those on the sides raised and elongate, arranged in linear series, one on each scale. Color of preserved specimens; Back, top of head, tip of snout, and around eyes, blue-black; sides and underpart yellowish, the scales margined with dusky dots. The white tubercles give the body the appearance of being striped with narrow white lines. Dorsal and

caudal with blue-black rays and pale membranes; pectorals, ventrals, and anal with pale rays and slightly dusky membranes. The males of the species are conspicuously marked with white tubercles, and many, though not all, of the females have them to a lesser extent. Specimens compared with Coregonus labradoricus may be readily distinguished by the sharper, less truncated snout, shorter appearance of the head, having more the general appearance of Coregonus quadrilateralis, yet differing from this in conspicuous details, such as body less slender, shape of head, less curved profile, less compressed snout and larger mouth.

This fish abounds in the chain of Eagle Lakes.

Fish Com. Bul. No. 486, V. 22, 1902 p.p. 366-7.

Salmo salar.
(Common Atlantic salmon)

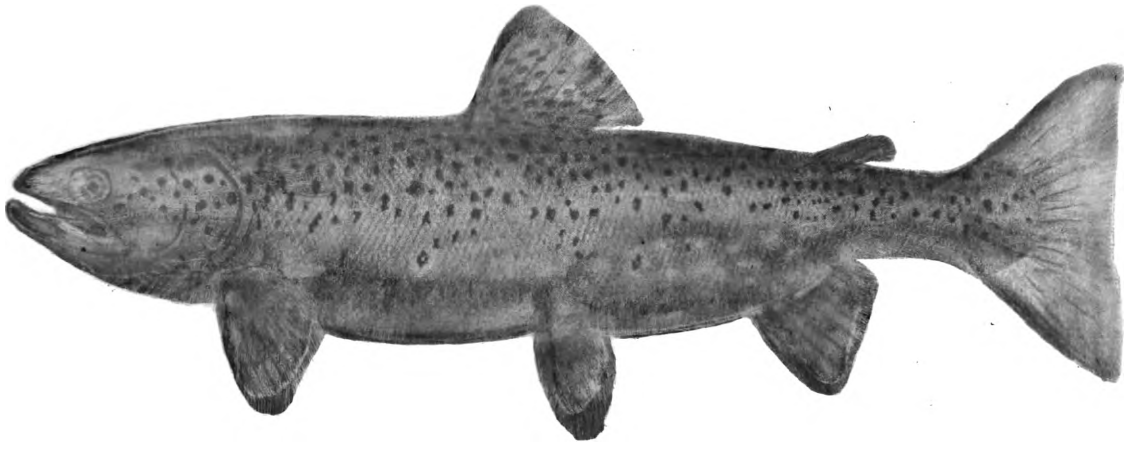
Head 4, depth 4, D.11; A.9 scales 23-120-21; vertebrae 60: pyloric coeca about 65. Body moderately elongate, symmetrical, not greatly compressed. Head rather low. Mouth moderate, the maxillary reaching just past the eye; in young specimens proportionately shorter. Scales comparatively large, rather largest posteriorly, silvery and well imbricated in the young; becoming embedded in adult males. Coloration in the adult, brownish above, the sides more or less silvery, with numerous black spots on sides of head, on body and on fins, and red patches along the sides in the males; young specimens (parrs) with about 11 dusky crossbars, besides black spots and red patches; the color, as well as the form of the head and body, varying much with age, food, and condition; the black spots in the adult often x-shaped or xx-shaped. Weight 15 to 40 pounds. North Atlantic, ascending all suitable rivers in northern Europe and the region north of Cape Cod to Hudson Bay: sometimes perfectly landlocked in lakes in Maine and northward, where its habits and coloration (but no tangible specific characters) change somewhat, when it becomes known as

Salmo sebago (landlocked salmon). (Girard)

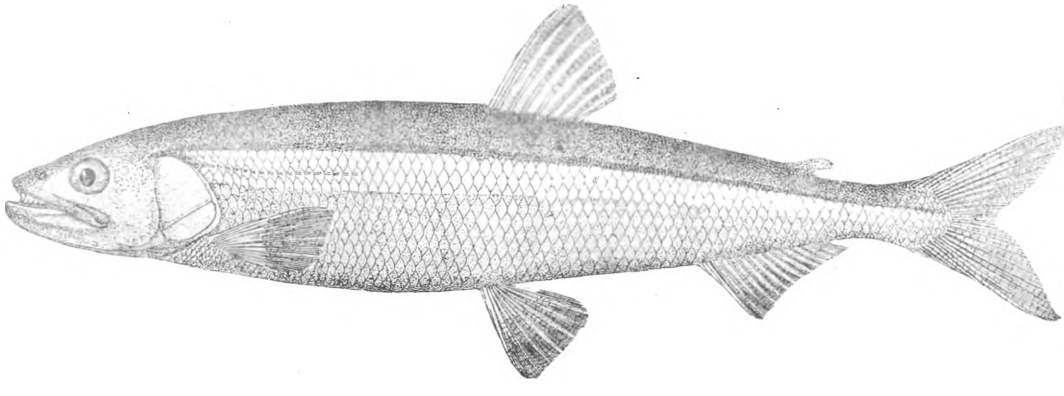
Smaller in size, rather more plump in form and non-migratory, not otherwise evidently different. Sebago Pond and northward, introduced in lakes in various parts of the country; seldom entering streams; reaches a weight of 25 pounds. According to Kendall (Fishes of Connecticut Lakes) "The salmon subsists upon fish and insects and in its native waters par-

ticularly upon smelts. In some waters this relation to smelts to a great extent determines the time and method of angling for the salmon. In the spring, when the smelt ascends streams and brooks or approaches the shore for the purpose of spawning, the salmon follows it and feeds greedily upon it. The salmon is then taken by trolling, with any bright lure, but mainly hooks or spinners, with a smelt or shiner bait. The salmon in some waters may be caught all summer and into September; in others it seldom bites after the first part of July, and in September it begins to run to the spawning grounds, the run continuing well into November. The spawning as a rule, takes place in November and the eggs hatch the following spring. In most instances, if possible, salmon ascend or descend streams to spawn upon gravelly bottoms in quickly running water.

This species is peculiar to Maine, New Brunswick and Nova Scotia. As a native of Maine, it is reported from only four river basins, viz., Presumscot, Kennebec, Penobscot, and Union.



LANDLOCKED SALMON, *Salmo sebago*



SMELT, *Osmerus mordax*

The Smelts.

Body elongate, covered with moderate or small scales, which are usually cycloid. Head naked. Mouth terminal, small or large, formed as in the "Salmonidae," the maxillary forming the margin of the upper jaw. No barbels; stomach a blind sac, with the pyloric caeca few or none. Dorsal fin short, nearly median; adipose fin always present; caudal forked; anal moderate; pectorals placed low; ventrals moderate, nearly median; no spines in the fins; Lateral line present; no phosphorescent spots. Abdomen rounded. Air bladder large, single. Ova large, falling into the cavity of the abdomen before extrusion. They are smaller and in every way feebler than the trout, but similar to them in all respects except the form of the stomach. Most of them are very delicate food fishes.

Osmerus mordax. (Mit.)
(American smelt; Freshwater smelt; Saltwater smelt).

Head 4; depth 6 1/2; D10; A15; scales 68. Body rather long and slender. Head large, with large mouth, and stronger teeth than in the other species of the genus. Small teeth along edge of maxillary; strong fang-like teeth on tongue, and front of ramer; mandible with moderate teeth; its tip projecting, maxillary extending to or a little beyond middle of eye. Scales deciduous. Dorsal fin rather posterior; the ventrals under its front; lower fins moderate, none reaching the next behind it. Gill rakers 2/3 diameter of eye. Transparent greenish above, silvery on sides; body and fins with some dark punctulations; Length 12 inches.

Its range is from New York to Gulf of St. Lawrence; it is a permanent resident of some lakes in Maine and New Hampshire; Lake Champlain and Memphremagog.

In Maine it is very common, being reported from all our river systems except the St. John.

Osmerus spectrum.* (Cope)
(Wilton smelt)

Head 4 1/4; depth 8 1/3; D10; A 15; scales 66-10. Eye 3 in head; slender; head short, with very large eye, and short mouth and maxillary; maxillary not extending beyond middle of pupil. Small.

So far as known it is peculiar to Wilson or "Wilton" pond in Wilton, Maine, where it is landlocked in fresh water.

Osmerus abbotii.** (Cope)
(Cobbosseecontee smelt)

Head 4 3/4; depth 7; scales 68-16. Eye smaller, 4 1/2 in head. Stouter, maxillary reaching posterior margin at pupil.

Landlocked in Cobbosseecontee Lake and recognized only from a limited area in Maine.

*(Osmerus mordax spectrum — Jordan & Evermann)

** (Osmerus mordax abbotii — Jordan & Evermann)

Salvelinus (charrs).

Body moderately elongate. Mouth large or small. Scales very small, 200 to 250 in lengthwise series. Fins moderate, the caudal forked in the young, truncate in some species in the adult. Sexual peculiarities not strongly marked, the males with the premaxillaries enlarged and a fleshy projection at the tip of the lower jaw. Coloration dark, with round crimson spots, the lower fins sometimes with marginal bands of black, reddish, and pale. Species numerous in the clear streams and lakes of the northern parts of both continents, sometimes descending to the sea where they lose their variegated colors and become nearly plain and silvery. The members of this genus are by far the most active and handsome of the trout and live in the coldest, clearest, and most secluded waters.

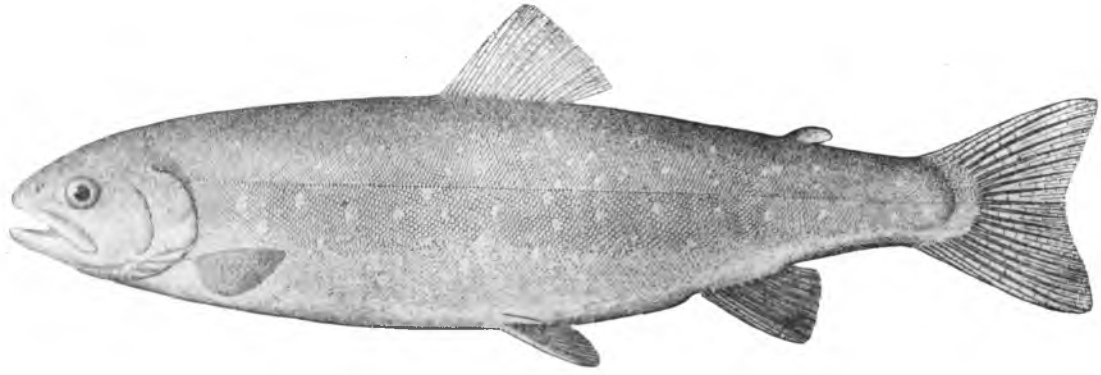
Salvelinus aureolus.*(Bean)
(Golden trout; silver trout)

Head 4 1/5; depth 4 1/5; D.9; A.8; scales 35-210-40. Maxillary reaching middle of eye; eye a little longer than snout; pectorals shortish; 1 2/3 in head, longer in males; dorsal rather low. Brownish, sides silver gray, with small orange spots on sides above and below lateral line; caudal grayish; belly orange; anal orange, edged before with white; ventrals orange, with a white band on outer rays; no mottlings anywhere, Length 12 to 18 inches.

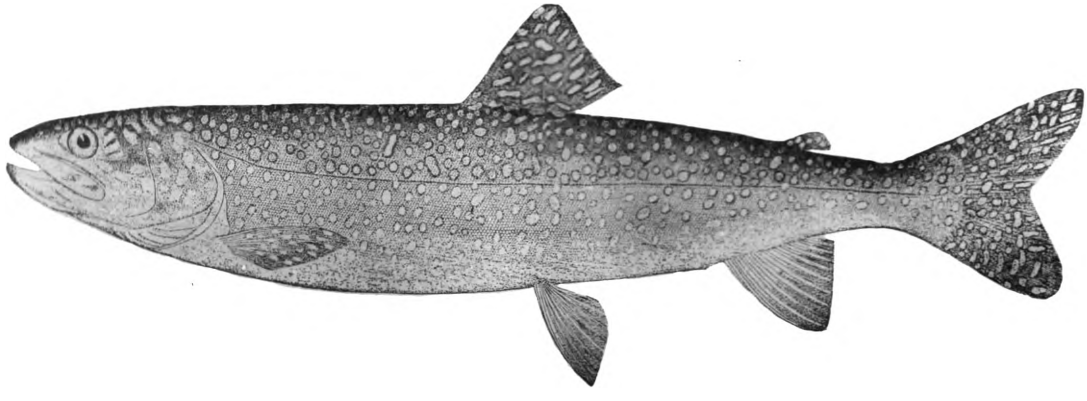
In referring to the trout from Sunapee Lake Mr. Quackenbos writes: The external characteristics of the Sunapee fish distinguish it conspicuously from the other charrs of New England. Its graceful build, small and delicately-shaped head, small mouth, excessively developed fins, more or less markedly emarginate caudal, spots without blue oreola, and unmottled back, at once separate it from the brook trout. The nuptial coloration is gorgeous beyond example among our indigenous "Salmonidae." As the October pairing time approaches, the fish is metamorphosed into a creature of indescribable brilliancy. The inconspicuous pale lemon spots of midsummer flame out in points of yellow or vermilion fire, while below the lateral line all is dazzling orange. The females are not usually as gaudily tinted as the males.

This species is recorded from Sunapee Lake and Dan Hale Pond in New Hampshire, Averill Pond, Vermont, and Floods Pond in Maine. Closely related species occur in Canada and northward to the Arctic Circle, Greenland, and in Europe.

*Salvelinus alpinus aureolus(Jordan & Evermann.)



GOLDEN TROUT, *Salvelinus aureolus*



TOGUE, *Salvelinus namaycush*

Salvelinus namaycush* (Walbaum).
(Great Lakes Trout; Mackinaw Trout;
Longe (Vermont); Togue (Maine); Namaycush)

Head 4 1/4, depth 4; eye large. Dorsal.11; Anal.11. lateral line 185 to 205. Body elongate, covered with thin skin. Head very long, its upper surface flattened. Mouth very large, the maxillary extending much beyond the eye, the head and jaws proportionally lengthened and pointed. Teeth very strong. Caudal fin well forked; adipose fin small. General coloration dark gray, sometimes pale, sometimes almost black; everywhere with rounded paler spots, which are often reddish tinged. Head usually vermiculate above; dorsal and caudal reticulate with darker. Length 36 inches. Reaches weight of 60 to 100 pounds, averaging about 17.

They are very abundant in the larger bodies of water; varying in form, size, and color in the different lakes, and hence has received many local names. They are often found in the same lakes with one or more kinds of whitefish whose slow helpless movements render them an easy prey. This trout is a fish of highly predaceous habit, living especially upon lake herring of all sizes, but eating in an emergency almost any animal food which comes its way.

A lake trout 23 inches long has been known to swallow a burbot of a length of 17 inches, and whitefish of two or three pounds weight are not infrequently taken from the stomachs of large trout. A twenty pound trout caught off Beaver Island in Northern Lake Michigan, had 13 herring in its stomach. "They are as omnivorous," says Goode, "as codfish, and

*(Christinomer namaycush-Jordan and Evermann)

among the articles which have been found in their stomachs may be mentioned an open jack-knife seven inches long, tin cans, rags, raw potatoes, chicken and ham bones, salt-pork, corn cobs, spoons, silver dollars, a watch and chain, and in one instance a piece of tarred rope two feet long."

The greater part of the year is spent by this fish in deep water, but in the spawning season it approaches the shore, depositing its eggs late in October, usually on rocky bottoms, at depths varying from 7 to 15 fathoms. The young appear in late winter or early spring.

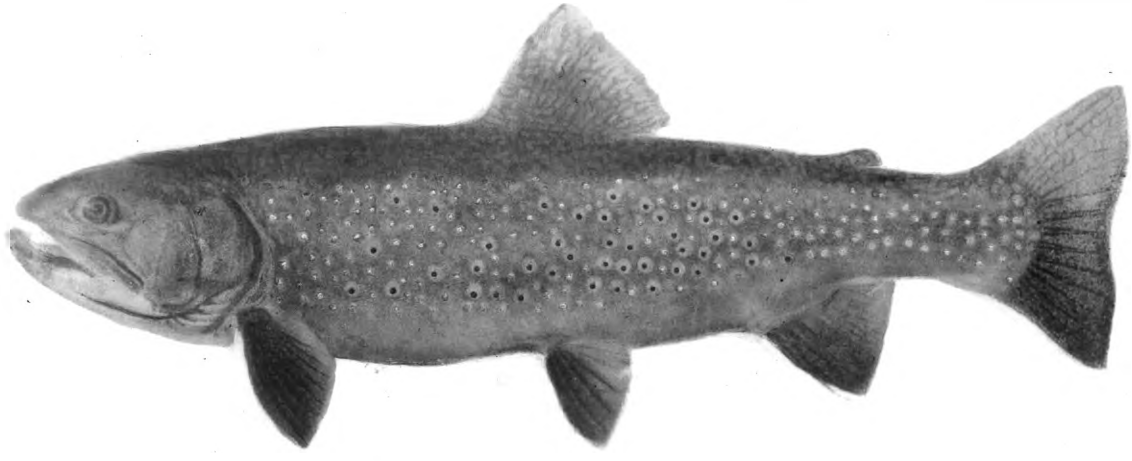
Lake trout are taken chiefly in pound and gill nets during their spawning season, - in September, October, and November, but they are also caught in deep water from the time the ice breaks up until late fall. They may be readily taken with a hook baited with a piece of fish, but they are not sufficiently "game" to reward the patient angler with a "first-class fight."

They are widely distributed, being recorded from Great Lakes, northern New York, New Hampshire, and Maine, the head waters of the Columbia and Frazer Rivers, streams of Vancouver Island and north to the Arctic Circle. They are found in most of the larger lakes and ponds of Maine, but are not reported as native to the Presumscot, Royals, Union, and Aroostook river basins.

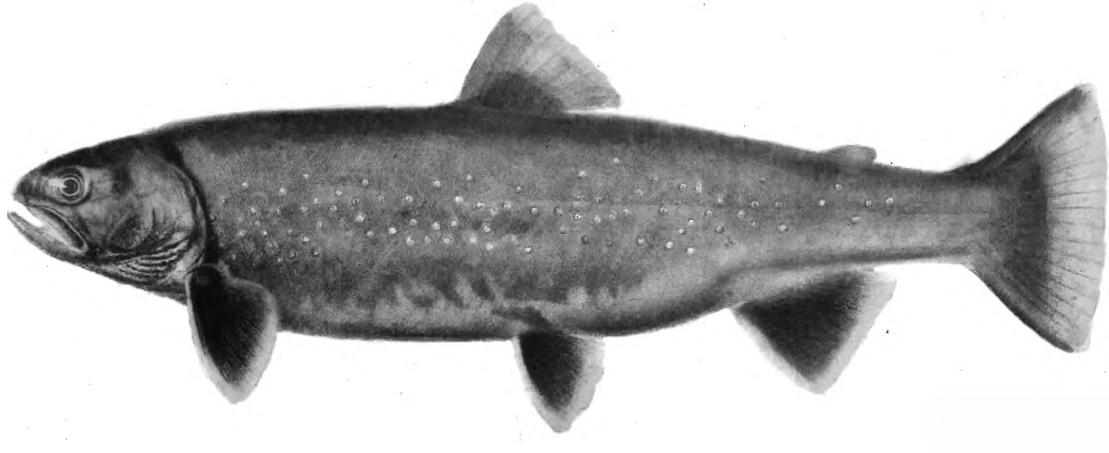
Salvelinus fontinalis.(Mit.)
(Trout; brook trout; speckled trout; squaretail; redspot)

Head 4 1/2; depth 4 1/2; D.10; Anal 9; scales 37-230-30; gill rakers small, not curled; Body oblong, moderately compressed, not much elevated. Head large, but not very long, the snout bluntish,- the interorbital space rather broad. Mouth large, the maxillary reaching more or less beyond the eye. Eye large, usually somewhat above the line of the axis of the body. Caudal fin slightly lunate in the adult, forked in the young; adipose fin small; pectoral and ventral fins not especially elongate. Red spots on the sides rather smaller than the pupil; back mostly without spots, more or less barred or mottled with darker; lower fins dusky, with a pale, usually orange band anteriorly, followed by a darker one; belly in the males often more or less red; sea-run individuals are often nearly plain bright silvery. Many local varieties distinguished by shades of color, also occur. Length 18 inches or less.

The brook trout is the best known of our charrs, abounding in all clear cold streams from Maine to the Saskatchewan and northward to Labrador, southward in the Alleghanies to the head waters of the Savannah, Chattahoochee, Catawba, and French Broad; largely introduced into western streams, but not native west of the Mississippi. The brook trout is native to all river systems in Maine.



BROOK TROUT, *Salvelinus fontinalis*



BLUEBACK TROUT, *Salvelinus oquossa*

Salvelinus oquossa.(Girard).
(Blueback trout)

Head 5; depth 5; eye large. 3 1/2 in head. Dorsal 10; Anal 9; scales 230. Body elongate, considerably compressed; less elevated than in the other species of this genus, the dorsal outline regularly, but not strongly curved. Head quite small, smaller than any other of our trout, its upper surface flattish; mouth quite small, the maxillary short and moderately broad, scarcely extending to the posterior margin of the eye. Jaws about equal. Scales small, those along the lateral line somewhat enlarged. Pectoral and ventral fins not elongate; caudal fin well forked, more so than in other species; preopercle as in Salvelinus fontinalis, but the lower limb more developed. Coloration dark blue, the red spots small and round, much smaller than the pupil, usually confined to the sides of the body; sides with traces of dark bars; lower fins variegated, as in Salvelinus fontinalis, Length 12 inches. Smallest and handsomest of the charrs; although quite different in appearance, it shows no important structural differences from Salvelinus aurealus, and may prove to be a variety of that species.

So far as known, peculiar to the Rangeley Lakes in Maine (where it is believed to be extinct) although a similar fish of Rainbow Lake, Maine, is provisionally identified as this species.

Fundulus diaphanus (top minnow). (Le S.)

Length 3 inches; body rather slender and not much compressed. caudal penduncle long; depth 4.5 to 5.3. Color (males) light olivaxeous, spotted with dusky on back and on sides above lateral line ; 15 to 20 dark transverse bars on each side, reaching from back to belly, broader than the silvery interspaces; belly silvery white; opercles emerald, dusted with dark specks; an emerald green spot behind opercle; iris mingled iridescent emerald to lavender, with a narrow inner rim of gold next to pupil; fins pale, dorsal with a faint longitudinal bar of dusky near base; base of caudal with a squarish golden spot. Females have dark bars shorter and narrower than in males, and the interspaces wider than the bars, olivaceous, without silvery luster; dorsal fin without dark bar; Head quite flat above; mouth small, lower jaw slightly projecting; teeth pointed, curved, the outer ones scarcely enlarged. Dorsal inserted in front of ventrals, its rays 13 or 14, anal rays 11, ventrals short of vent; scales 43 to 45; transverse series 14 or 15; no lateral line; cheeks and opercles covered with large scales. They are oniporous.

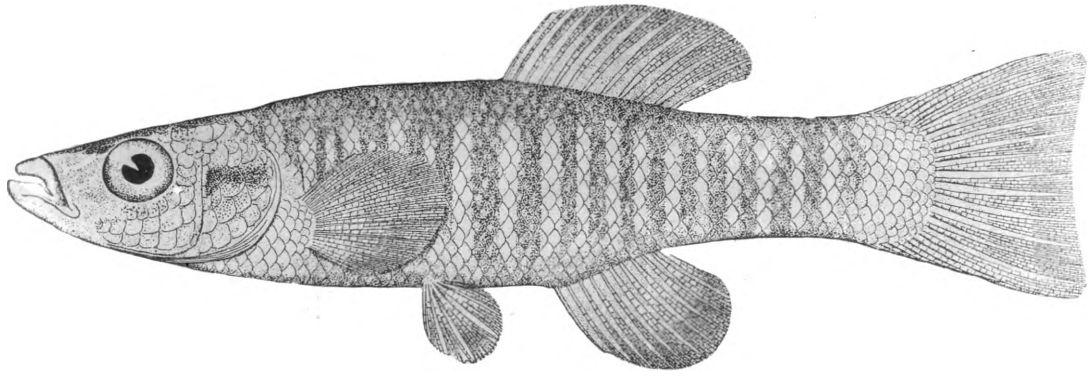
The name top minnow has been given to them as they are surface swimmers, inhabiting canals, ponds, swamps, and sluggish or stagnant streams, where they feed on insects and other life found swimming or floating at the surface of the water. They are carnivorous in greater or less degree.

Females moderately distended with large eggs were taken in Sand Lake, Ill. on August 3, 1887, a fact which indicates a late spawning

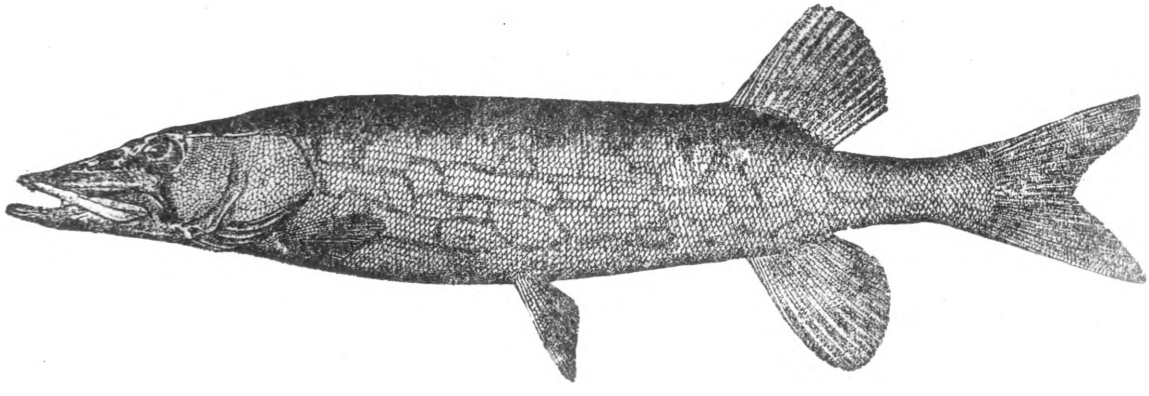
period. Dr. Eigenmann, however, found the eggs of this species in grassy bottoms of Indiana lakes June 24.

The range is from the Gulf of St. Lawrence to Texas.

It is a common minnow in Maine and is reported from the Androscoggin, Kennebec, Penobscot, Union, St. Croix and Fish River Basins.



TOP MINNOW, *Fundulus diaphanus (male)*



PICKEREL, *Esox reticulatus*

Esocidae. (Pikes)

Body elongate; head long, the snout prolonged and depressed. Mouth very large, its cleft forming about half the length of the head; lower jaw the longer; gill openings very wide; Scales small; lateral line weak, obsolete in young specimens, developed in the adult. Dorsal posterior, opposite and similar to anal; no adipose fin; no barbels; stomach not caecal; air bladder simple.

The species are all noted for their greediness and voracity; "Mere machines for the assimilation of other organisms."

"A solemn, stately ruminant fish, lurking under the shadow of a lily pad at noon, with still,circumspect, voracious eye, motionless as a jewel set in water, or moving slowly to take up its position; dashing from time to time at such unlucky fish or frog or insect as comes within its range and swallowing it at a gulp. Sometimes a striped snake, bound for greener meadows across the stream, ends its undulatory progress in the same receptacle." Thoreau.

The flesh is excellent, being white and flaky and of delicate flavor.

Esox reticulatus.(Le S.)
(Common Eastern pickerel; Green pike.)

Head 3 1/2, depth 6; eye small. D.14; A.13 (counting developed rays only); scales 125. Body rather slender, deepest near the middle and tapering backward to a slender caudal peduncle; head long, the snout prolonged. Middle of eye midway between tip of chin and gill opening. Cheeks and opercles entirely scaly; caudal well forked.

Color green, of varying shades; sides with golden luster, and marked with numerous dark lines and streaks, which are mostly horizontal, and by their junction with one another produce a reticulated appearance; a dark band below eye; fins plain. Length 24 inches.

It prefers clean, clear, cool water of a sluggish current, in which it remains generally quiet by day. It is a strong and active swimmer, extremely voracious, and with senses remarkably acute. It launches itself like an arrow upon its prey, seldom missing its aim, and fighting courageously with others of its kind. It is purely carnivorous, its food consisting of fishes, including sunfish and black bass, together with frogs, crawfishes, and the larger insects. Mice, reptiles, and young ducks have been reported by various authors to have been taken from the stomachs of pickerel.

The common pickerel of Illinois (Esox Lucius) spawns in March. Prof. Benecke of Konigsberg says of this species that "it lives a hermit life, only consorting in pairs during the spawning season. The pairs of fish then resort to shallow places upon meadows and banks which have been overflowed, and, rubbing violently upon each other, deposit their spawn in the midst of powerful blows of their tails."

It is often caught with a hook through holes in the ice in winter. It is readily captured with minnow bait or with a trolling-spoon, and will also take a fly.

Its range is from Maine to Florida and Louisiana, west to Arkansas. It is widely distributed in Maine, the St. John river basin being the only one to which it is not a native.

Gasterosteidae (Sticklebacks).

Body somewhat compressed, tapering behind to a slender caudal peduncle; skin naked or with vertically oblong bony plates; no true scales, ventral fins abdominal or subabdominal, consisting of a stout spine and one or two rudimentary rays; dorsal fin preceded by two or more free spines; no mesocoracard pyloric caeca present; few in number; air-bladder simple.

The fresh water sticklebacks are very similar in their habits; all are active, pugnacious, and greedy, and in spite of their small size, they are known to be very destructive to the fry of other fishes. In certain localities along the Atlantic Coast they occur so abundantly as to be a nuisance to the fishermen, clogging the nets used for smelts. Certain European species will bear with immunity transplantation from fresh water into salt water, and vice versa.

Most or all of the sticklebacks build nests, constructing them of sticks which they fasten together by silk-like threads formed from the secretion of a gland, found only in the males. The substance secreted by this gland, which is in reality the kidney, is much like the mucin secreted by the vineyard snail, Helix pomatia. The nest is built by the exertions of the male alone, among the stems of aquatic plants where there is some current. It has two openings which are "as smooth and symmetrical as the hole leading into a wren's nest, and not unlike it." The male induces the female to enter the nest and lay her eggs, after which he enters and deposits his milt. The holes in the nest are in the

direction of the current, so that a stream of water passes through it constantly. The pugnatious male watches the nest and wards off all intruders.

Pungitius pungitius.* (Linn.)
(9 spined stickleback)

Length 3 inches; body quite slender, considerably compressed, the caudal peduncle very long, slender and tapering, broader than deep, and with lateral bony keel; depth 5.1 to 5.6. "Color olivaceous above, profusely punctulate, irregularly barred with darker; silvery below. Head 3.3 to 3.7. Dorsal IX (or X), 9 or 10, the spines promiscuously divergent to right and left at various angles; anal rather low, the spine nearly as long as anterior rays; ventrals with a long finely serrated spine, which is less than 3 in head; post pectoral plate well developed, thoracic processes prominent, forming V-shaped figure. Skin naked except for small bony plates along dorsal and anal and on caudal keel.

It inhabits both fresh and brackish waters, and is found throughout northern Europe, and in North America as far southward as the Great Lakes region. It is thus a strictly northern species.

In Maine it is fairly widely distributed being reported from the Presumscot, Royals, Penobscot, St. Croix, and Fish River Basins.

* Pygosteus pungitius - Jordan & Evermann.

Gasterosteus atkinsii.*(Bean)
(Freshwater stickleback; stickleback)

Head 3 1/3; depth 4 3/4; eye 3 1/4, snout a little greater than eye, pointed; mouth oblique, maxillary shorter than eye. D II-I, 12; A. I, 8. Lateral plates variable, usually from 10 to 22 in number, the posterior ones small and weak; caudal peduncle depressed, keel usually developed, First and second dorsal spines long and slender, about as long as from tip of snout to pupil, slightly serrate; pectoral spine also long and slender, nearly as long as snout and eye, strongly serrate, and with cusp at base on outer side; ventral plate long and narrow, about as long as the ventral spines. Pectoral plate broad and deep. Upper part of body dark; more or less distinct, dark cross bands on posterior part of body, darkest on caudal peduncle; base of caudal fin with a black bar; under parts silvery except on caudal peduncles, where there are a few punctulations.

Range-Maine, New Brunswick, and Quebec. In Maine it is widely distributed, being reported from the Androscoggin, Kennebec, Penobscot, Union, St. Croix, and St. John River Basins.

*Gasterosteus bispinosus atkinsii.

Eucalia inconstans (brook stickleback).(Kirt.)

Length 2 1/2 inches; body rather deep and moderately compressed; caudal peduncle rather stout and not keeled; depth 3.8 to 4.4; greatest width about 3/5 of greatest depth. Color (females and young) olivaceous, with faint lighter mottlings and with many fine dots of black; upper part of sides and caudal peduncle with about 10 dark cross-bar-like bands more or less confluent in ring-like pattern; lower parts silvery; upper part of cheek and opercle crossed by a splash of bright green; median fin more or less dusky; spring males said to be jet black, tinged with red anteriorly. Head 3.2 to 3.8. Dorsal V (or VI), 9-10, the spines in a right line, not divergent; caudal subtruncate; anal rather large I, 9 or 10, the spine shorter than the anterior rays; ventrals with a short but strong and sharp spine with minute serratures; post pectoral plate present; thoracic processes slender and covered with skin, widely separated; pubic bones firmly united, forming a lanceolate, keeled process which extends backward from between ventrals. Skin smooth, destitute of dermal plates.

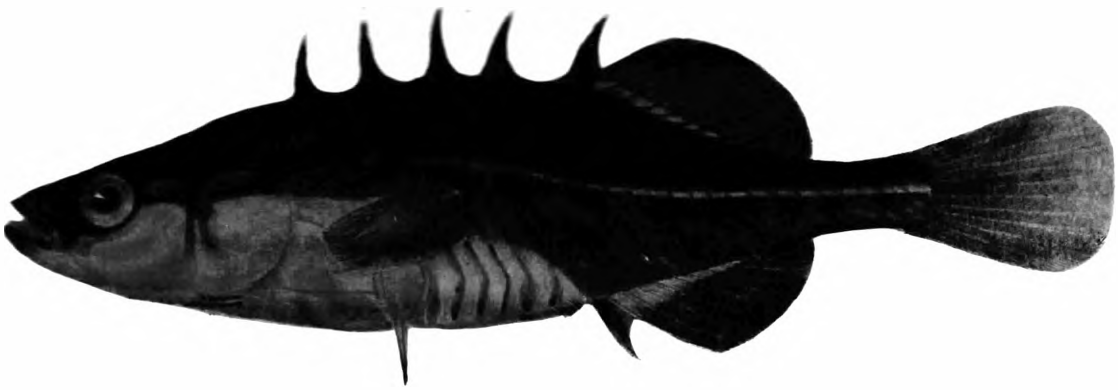
It is confined to fresh waters, and prefers cool, clear brooks. This species builds nests, like the others of its family. In the aquarium it is quarrelsome, and destructive even to fishes of larger size.

Its mouth is small, its gill rakers are long and slender, about half the length of the corresponding filaments, and its pharyngeal apparatus is insignificant. The intestine is short and simple, not longer than head and body together. Notwithstanding this equipment for a carnivorous life

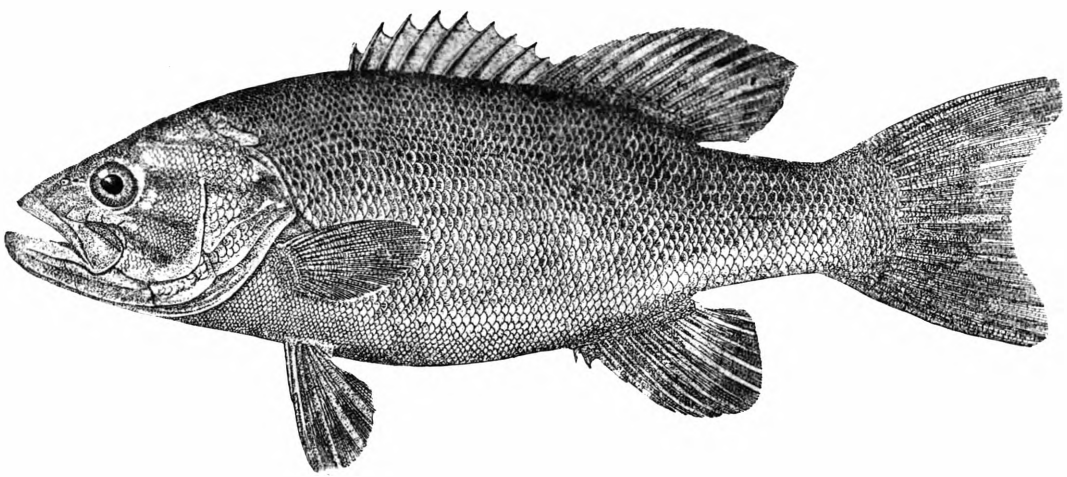
specimens have been found which had fed on plants and animals in equal quantities; It is evident that it feeds, in part at least, upon the bottom.

Aside from one locality in Maine and from New Brunswick this species has not been recorded east of New York and Montreal. Its former recorded range is from New York to Kansas and northward to the Saskatchewan, south to Central Ohio and Illinois.

In Maine it is found in a tributary of Cobbosseecontee Lake of the Kennebec River system.



STICKLEBACK, *Eucalia inconstans*



SMALL-MOUTHED BLACK BASS, *Micropterus dolomieu*

Micropterus dolomieu. (Lacé.)

(Small mouthed black bass).

Length 12 to 15 inches; body rather elongate; moderately compressed, becoming deeper with age. Mouth large but smaller than in Micropterus salmoides (large-mouthed black bass), the maxillary ending considerably in front of the hinder margin of the orbit, except in very old samples. Scales on the cheek minute, in about 17 rows; scales on the trunk comparatively small. Gill rakers long. Dorsal fin deeply notched, the ninth spine being about half as long as the fifth and not much shorter than the tenth; base of soft dorsal and anal scaly. Coloration dull golden green, with bronze luster, young with darker spots along the sides, which tend to form short vertical bars, but never a dark lateral band; 3 bronze bands radiating from eye across cheeks and opercles; a dusky spot on point of operculum; belly white; caudal fin yellowish at base, then black, with white tips; dorsal with bronze spots, its edge dusky. In some waters the fin-markings are obsolete, but usually they are very conspicuous in the young. Adult specimens have all these marks more or less obliterated, and become ultimately of a uniform dead green, without silvery luster. Dorsal X (or IX), 13-15; anal III (rarely IV or II), 10-12; ventrals more than half to vent; pectorals short; Scales 10-12, 66-78, 19-22; lateral line complete or nearly so.

"The black bass is eminently an American fish; he has the faculty of asserting himself and of making himself completely at home wherever

placed. He is plucky, game, brave, unyielding to the last, when hooked. He has the arrowy ruch and vigor of a trout, the untiring strength and bold leap of a salmon, while he has a system of fighting tactics peculiarly his own. I consider him inch for inch and pound for pound the gamest fish that swims." (J. A. Henshall)

It shows a marked preference for a swift current and a clean bottom, and cold water. Some small lakes that are rather shallow, whose bottoms are chiefly mud and whose waters are warm, are found to be well suited for the large-mouthed black bass and to be entirely without small mouthed black bass, but small lakes of considerable depth, cool water, and with bottom partly of mud and partly of sand and gravel, seem equally well adapted to both species.

Curiously little is known of its food, the literature of the subject containing only general statements apparently based on ordinary observations. The stomach contents of several specimens taken from The Bowl on Mt. Desert Island showed that the food consisted almost wholly of dragon flies and damsel flies. The fish could be seen leaping into the air after the prize;dragon flies used as bait were much more satisfactory than either worms or minnows.

The small-mouthed bass hibernates in winter, going into deep places under the shelter of rocks and remaining torpid till spring (Tisdale).

This species builds a nest, usually in about three feet of water on a bottom of sand or gravel. The male roots down into the bottom,

fanning away the sand with his tail, until mud is reached, about 3 or 4 inches below the sand. The sand forms a ridge a few inches high around the nest, and a log often forms an additional shelter on one side. The females are not about during nest-building, which occupies from 4 to 48 hours. When the nest is finished, the male seeks the female to induce her to enter the nest, biting her gently and swimming across beneath her, striking her as he passes. The eggs and milt are deposited with the vents of the two sexes approximated. After the eggs are all laid, in successive ovipositions, the male drives the female away, himself remaining alone to guard the nest. Dr. Reighard has found that the male cares for the eggs until hatched, and watches over the young till they are well grown. He found the small-mouthed bass spawning in Michigan between the end of April and the end of June. Tisdale states that it takes six years for a weight of 3 pounds to be reached, growth continuing after that at about half a pound a year until a weight of 6 pounds is attained.

Though practically unexcelled as a fresh-water game fish, this species does not take the highest rank as food.

Artificial propagation by taking and impregnating the eggs has not been successful. The eggs are not stripped easily, and it is necessary to kill the male in order to get the milt. Pond culture is resorted to with considerable success, the percentage of natural fertilizations in well-regulated ponds closely approaching the percentage obtained by artificial means for species best adapted to artificial

culture. This high ratio is of course due to the fact that the parent guards the eggs. The fry will endure shipping long distances in the cool days of spring, or autumn or in midwinter.

The range is from Lake Champlain to Manitoba and southward on both sides of the mountains to South Carolina and Arkansas in cool waters. The black bass has become so well established and so widespread in Maine that it is here considered to be a Maine fish.

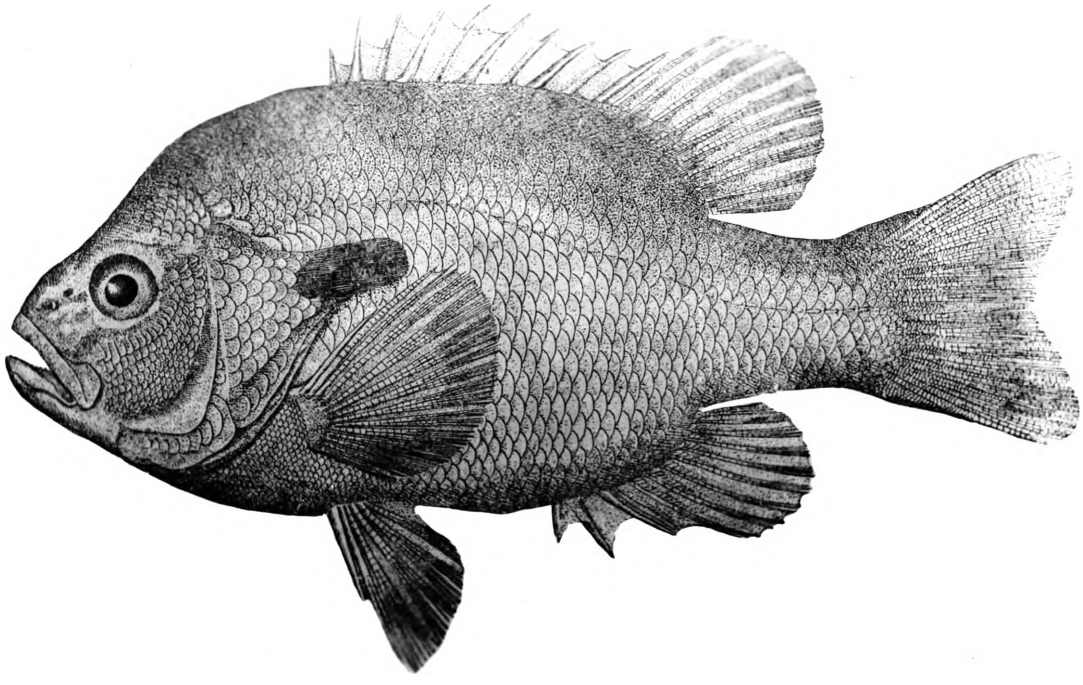
Lepomis auritus.(Linn.)

(Red sunfish; long-eared sunfish; "Quiver"; "Roach"; Redbreast Bream).

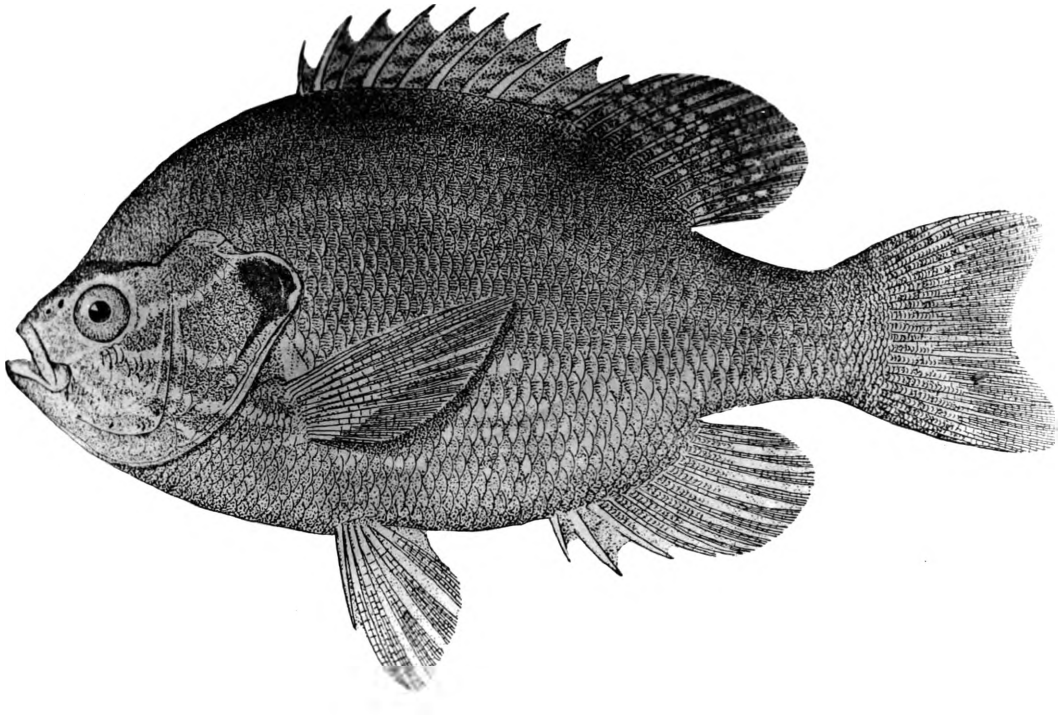
Head (without flap) 2 3/4 to 3; depth 2 to 2 1/2; eye 4 to 4 1/2 in head. D. X, 11 or 12; A. III 8 to 10; scales 6-43 to 48-15, 40 to 45 pores; 7 rows of scales on cheek; scales on breast very small. Body elongate, not much elevated. Snout moderately prominent; mouth rather large, oblique, the maxillary reaching past front of eye. Opercular flap very long, narrow, usually not wider than eye; in the young the flap is variously shorter, but always narrow; lower margin of flap usually pale. Dorsal spines rather low, the longest 3 in head. Color olive; belly largely orange red; scales on the sides with reddish spots on a bluish ground; vertical fins chiefly orange or yellowish; head usually with bluish stripes, especially in front of eye, most distinct in adult; fins becoming dusky in spirits; no dusky blotch on last rays of dorsal and anal. Length 8 inches.

Maine to Louisiana; abundant in all streams east of the Alleghanies; the typical form above described chiefly northward.

In Maine it is found in the Androscoggin, Kennebec and Penobscot waters.



LONG-EARED SUNFISH, *Lepomis auritus*



PUMPKINSEED SUNFISH *Lepomis gibbosus*

Lepomis gibbosus.*(Linn.)
(Pumpkinseed sunfish).

Length of adults 5 to 8 inches; body strongly compressed, short and deep, the back very highly arched in adults, ventral outline less curved than dorsal. Coloration exceedingly brilliant and somewhat variable, olive to grassy greenish, the back and upper portion of body finely dusted with gold or emerald; sides with quite numerous and irregularly distributed large roundish blotches, which are olive to coppery in front and darker behind, or dark all about a roundish coppery-colored central spot; single scales below lateral line each with a quadrate central spot, these spots forming rows from before backward, alternate ones coppery and forming the central or anterior spot of the large blotches before mentioned, the other bright emerald or turquoise-blue; belly light olive to orange-yellow; cheeks and opercles crossed by four or five wavy lines of emerald, the interspaces with mingled coppery and gold over the ground olive, producing the effect of a rich bronze in well-colored examples; flap of opercle velvety black behind; a definitely bounded roundish spot of orange or turkey-red on the lower posterior portion of the fleshy margin; the margin above and below the spot dark to blackish with some coppery luster; membranes of both portions of dorsal and of caudal and anal somewhat irregularly barred with dull brownish to orange blotches; ventrals dusky in males, paler or entirely pale in females. Head small 2.8 to 3.2 in length; the snout with a somewhat smubbed appearance, very

*Eupomotis gibbosus — Jordan & Evermann.

short; mouth small, the jaws equal; the maxillary reaching but a little past front of orbit; lower pharyngeals broad and deep with inferior and lateral prominences; the teeth short and stout; operculum quite firm behind, the bony portion distinct from a broad, paler fleshy margin; gill rakers short and soft; Dorsal X, 11 or 12; the spines rather high, about as long as snout and eye. Anal III, 10 or 11; pectorals rather long, ventrals exceeding vent, usually reaching to or a little past first anal spine. Scales 5,35-40, 13 or 14; 4 or 5 rows on cheek.

The pumpkinseed prefers clear streams. As it is very well fitted to crush and devour mollusks they make up a large per cent of the food. Insects and crustaceans are also eaten.

The males prepare a circular nest by removing seeds and dead aquatic plants for a space of a foot in diameter, excavating to a depth of 3 or 4 inches. The nests are in shallow water, and are encircled by aquatic plants, space being left open for the admission of light. Observations indicate that the male alone is concerned in building the nest. Probably the male guards the nest and young although the female may be present. The male in approaching the female to induce her to enter the nest elevates and puffs out his gill-covers and erects his ear-flaps, so that there is a brilliant display of color to the female in front. The spawning season is May to June.

The pumpkinseed is a good pan-fish, but is not especially important as a commercial product. It is sufficiently hardy to be transported with ease, and has been acclimatized in Europe. It is one of the best of fishes

for keeping ponds free from mosquitoes.

Its distribution is from the Great Lakes region to New Brunswick and southeast of the Alleghanies to Virginia; rather rare farther south.

It is fairly common in Maine, being reported from the Presumscot, Androscoggin, Kennebec and St. Croix systems.

Perca flavescens (Mit.)
(Yellow perch; ringed perch; American perch).

Length 1 foot; body only moderately elongate, considerably compressed; back elevated, highest in front of spinous dorsal; the profile convex from first dorsal spine to occiput, thence straightish or slightly concave to muzzle; depth 3.3 to 3.8; greatest width about 5/7 of its depth. Color of sides and back brassy green to golden yellow, with several broad bars of dusky crossing each side from back nearly to belly; belly whitish with reflections of green, salmon, and yellow; iris brassy at edge; spinous dorsal gray, usually with a black spot on last two membranes; soft dorsal and caudal plain green; pectorals transparent grayish green; ventrals and anal variously light grayish green or orange to crimson according to season and habitat. Head 3 to 3.5; nose longer than eye; maxillary to middle of orbit; opercle ending above in several coarse jagged points; preopercle strongly serrate, especially below; the largest gill rakers more than half the length of bronchial filaments; pyloric caeca 3. Dorsal XII to XIV-II or III, 12 to 13; longest spine a little more than 2 in head; length base of soft dorsal about 3/5 base of spinous; caudal lunate; anal II, 7-8; ventrals more than half way to vent. Scales 6 or 7, 57-62, 15-18; lateral line nearly or quite complete; cheeks scaled, in about 8 to 10 rows.

It is essentially a lake fish, but occurs also in running streams, most abundantly in large rivers and least so in creeks. It is wholly carnivorous, but differs greatly in its food according to the situation from which it comes. Eighteen river specimens, for example, had made but

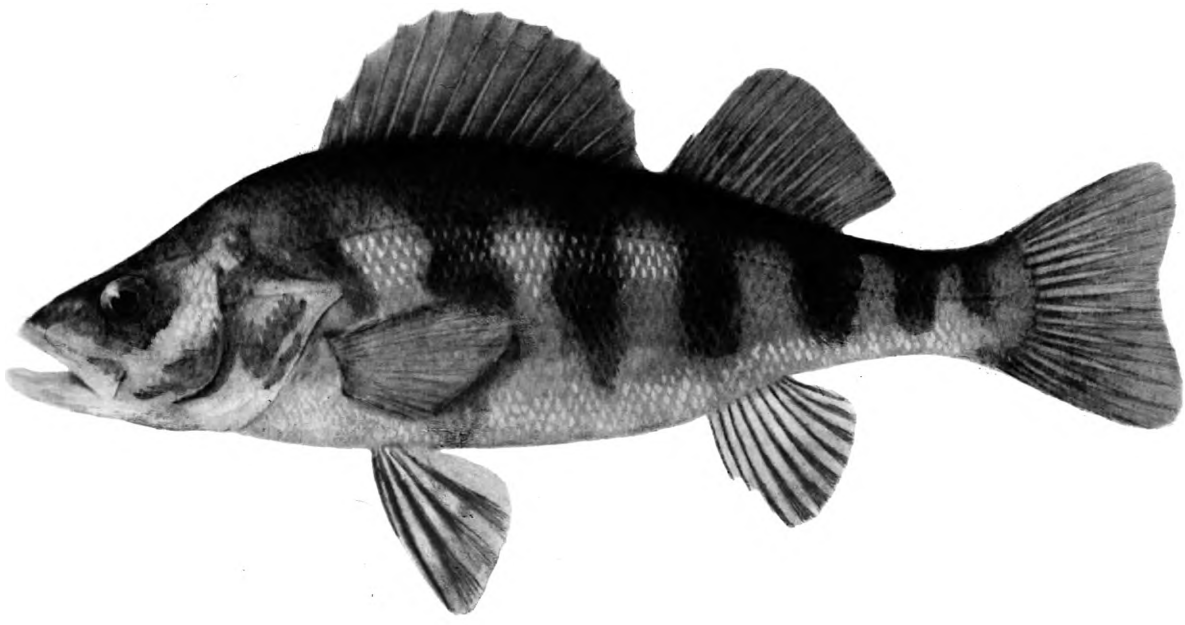
6 per cent of their food of fishes, about a fifth of it of the smaller thin-shelled mollusks, a fourth of it of insect larvae, and nearly half of it of crustacea - crawfishes, fresh-water shrimps, amphipods and isopods - while a dozen lake specimens, on the other hand, had eaten nothing but fishes and crawfishes, the former greatly predominating. The perch is said by Cole to eat the spawn of other fish. There is a notable difference, also, between the lake and river perch in respect to their coloration, the latter being usually much the more brilliant.

The yellow perch may reach the length of a foot and a weight of more than two pounds, but does not commonly weigh much more than a pound. It spawns in spring, usually during April and May, when the temperature of the water is from 44° to 49°F. Ripe males were taken by Craig at Havana, Ill. on May 3, 1899. According to Dr. C. C. Abbott, the sexes go in pairs to the spawning beds, which are selected near shore where there is a sandy or pebbly bottom. The eggs are laid in flat bands, and after fertilization and "water hardening" they increase greatly in size. A single adult deposited in the aquarium of the Washington station of the U. S. Fish Commission a string of eggs 88 inches long, which, after fertilization weighed 41 ounces.

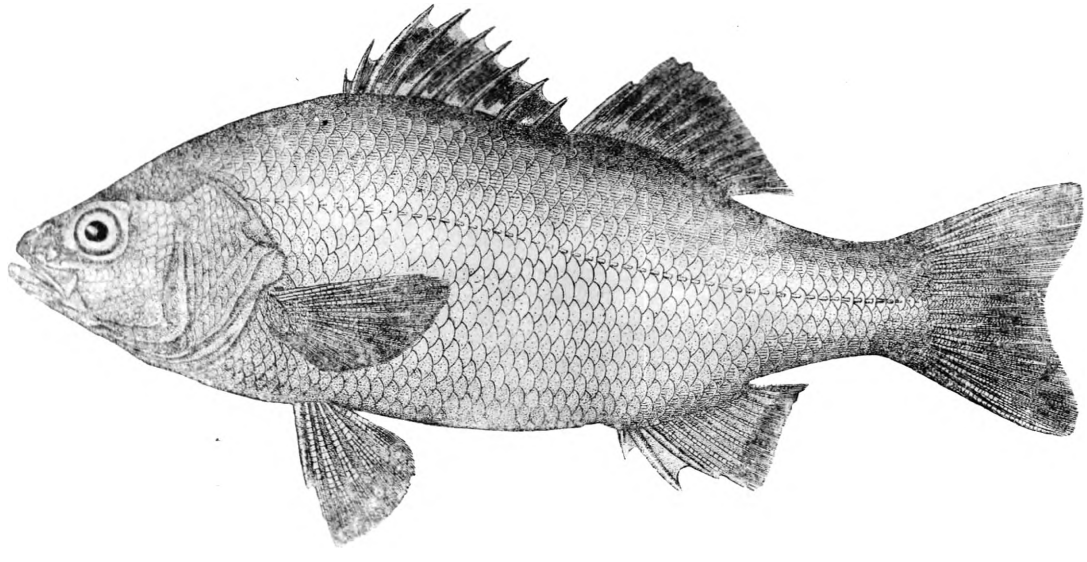
This perch is taken in fykes, gill-nets, and traps, or with seines and hooks. It is a good pan-fish, the flesh being white, firm, and of excellent flavor, better, however, in northern localities than in southern. "As a game fish, the yellow perch can be commended chiefly on account of the fact that anybody can catch it. It can be taken with

hook and line any month of the year, and with any sort of bait, - grasshoppers, angleworms, grubs, small minnows, pieces of mussel, or pieces of fish; and it will even rise, and freely, too, on occasion, to the artificial fly. It is easily taken through the ice in winter, when small minnows are the best bait." A state Laboratory assistant some years ago made an experiment at simple and inexpensive fishing for the yellow perch from a pier in South Chicago. With a piece of lath for a pole, a line of cotton twine, a small hook, and a bit of pork for his first bait, he caught a single perch, cut this up as bait for others, and within an hour had a string of seventy-five.

This fish is abundant in the Great Lakes and in coastwise streams from Nova Scotia to North Carolina; upper Mississippi and St. Lawrence waters. In Maine it is reported from all river basins except the Royals, and the Aroostook and Fish Rivers of the St. John system.



YELLOW PERCH, *Perca flavescens*



WHITE PERCH, *Morone americana*

Morone (White Perch).(Gmelin.)

Body rather short and deep; compressed; maxillary broad, naked, without supplemental bone. Lower margin of preopercle simple serrate or entire. Spines strong, 10 in dorsal fin; dorsal fins more or less connected by membrane; second anal spine much enlarged; Lower jaw slightly projecting. Scales rather large, ctenoid; top of head scaly; lateral line little arched. Ventrals inserted well behind pectorals.

Morone americana.
(White Perch; "Sea Perch"; "Sea Bass")

Head 2 3/4 to 3; depth 2 1/2 to 3. Dorsal IX-I, 12; anal III, 8 or 9; scales 8-50 to 55-12, 50 to 55 pores. Body oblong, ovate, the back moderately elevated; head depressed above the eyes; the snout rather pointed; mouth small, somewhat oblique, the maxillary not reaching middle of orbit, its width at tip half eye; eye moderate, scarcely as long as snout, 4 in head; base of tongue without teeth; head scaled to between the nostrils. Dorsal and anal spines moderate, the longest dorsal spine 2 in head; the second anal spine 2 1/2 to 3, as long as third spine; dorsal fins considerably connected. Color olivaceous, varying to dark green; sides silvery or olivaceous, usually with faint, paler streaks; Length 8 to 14 inches.

They are found on the Atlantic Coast of the United States from Nova Scotia to South Carolina, ascending streams and frequently landlocked in ponds, the pond specimens much darker in color; one of the most abundant

and characteristic fishes of the brackish waters and river mouths of our Atlantic Coast. A very excellent pan-fish. Specimens from Woods Hole represent the variety called "nigricans," very dark green in color, scarcely paler below, the body deeper and the spines lower and shorter than in the common White Perch; this form occurs landlocked in fresh-water ponds, a permanent resident in rivers southwards and in some northern lakes. In Maine it is reported from all our river basins except of the Royals, the Union and the St. John Rivers.

Family Cottidae.

Cottus (Miller's thumbs).

Fresh water sculpins. Body fusiform. Head feebly armed; skin smooth or more or less velvety, its prickles, if present, not bony or scale-like; villiform teeth on jaws and romer, and sometimes on palatines. Dorsals nearly or quite separate, the first of 6 to 9 slender spines; ventrals moderate, each with a short concealed spine and 4 soft rays. Lateral line present, usually more or less chain-like, sometimes incomplete. Preopercle with a simple spine at its angle which is usually curved upward, its base more or less covered by skin, very rarely obsolete; usually 2 or 3 spines turned downward below this; subopercle usually with a concave spine turned downward.

They are fishes of small size, inhabiting clear waters in the northern parts of Europe, Asia, and America. The species are extremely numerous, and are very difficult to distinguish, all being similar in form, coloration, and habits. The Miller's Thumb, or Blob, is found in most streams where trout occur, and it is one of the most destructive enemies of the trout, devouring its eggs in great numbers.

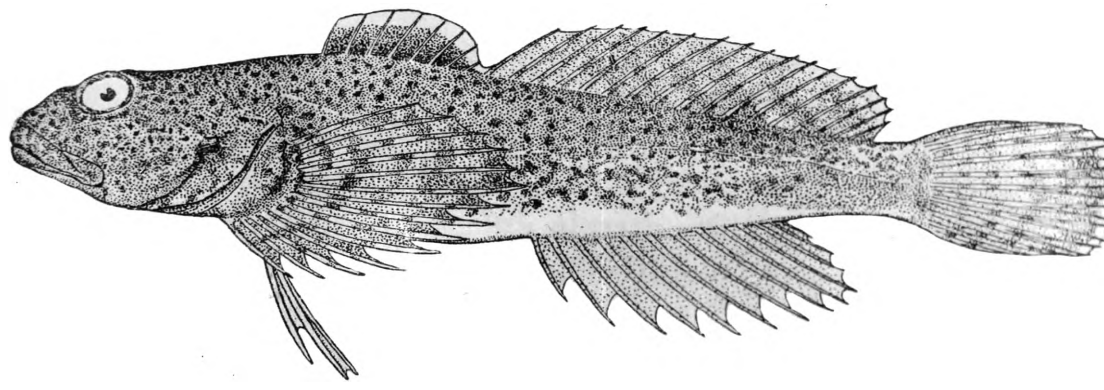
Cottus gracilis.* (Heckel)

(Blob; Freshwater Sculpin; Miller's Thumb; "Rock cusk"; "Brook cusk").

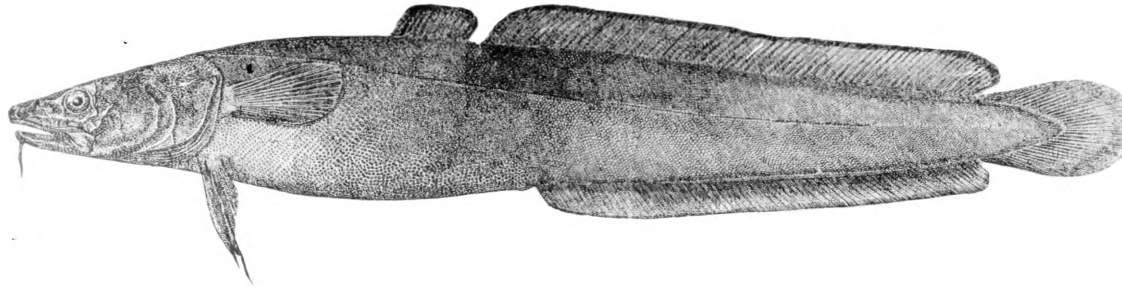
Head 3 1/2; depth 5. Dorsal VIII, 16; anal 12. Body rather slender, fusiform; preopercular spine moderate, concealed. Mouth rather large, the maxillary reaching to the pupil; pectorals reaching front of

anal; ventrals about to vent. Color olivaceous, mottled, upper edge of spinous dorsal red in life. Streams of New England and New York, recorded from tributaries of the Connecticut, Lake Champlain, Hudson, Delaware, and Susquehanna, Common; probably a variable form. In Maine they have been reported from the Presumscot, Androscoggin, Penobscot and St. John River Basins.

*Uranidea gracilis (Jordan & Evermann).



MILLER'S THUMB, Cottus gracilis



CUSK, Lota maculosa

Lota maculosa.(Le S.)

(Burbot; ling; eel-pout; freshwater cusk).

Length 2 feet; body extremely elongate, not much compressed, except posteriorly, the back low and the profile long and straight; depth 7.6; greatest width of body about .7 to .9 greatest depth. Color dark olive, thickly marbled and reticulated with blackish, yellowish or dusky beneath; young often sharply marked, the adult becoming dull grayish; vertical fins with dusky margins. Head broad and depressed 4.7 to 5 in length; nose 2 1/2 times eye; each nostril with a short barbel (1/2 eye); mouth horizontal, rather large, maxillary past back of pupil; chin with a single median barbel 1 1/2 times length of eye; gill-rakers short. Dorsal 12 or 13, 70 to 75,the second very long and low, its longest rays less than half head; caudal and anal slight; anal rays about 65; ventrals inserted before pectorals; scales very small, embedded,27 to 30 in an oblique series from front of second dorsal to lateral line, cheeks and opercles with very small embedded scales; all fins more or less scaly.

The burbot lives in deep water, where it lies during the day under shelter of stones. It is exceedingly voracious not even sparing its own kind. One fish, 16 inches long, examined by Thompson contained ten dace none of which was less than four inches long. Fish constitutes a large percentage of their food. The flesh of the burbot is coarse and tasteless, and is seldom used for food. It is, in fact, of less value than any other

*U, S. Fish Comm. 1894, p. 603.

American fresh water fish of its size unless it be the gar which doubtless equals it in destructiveness where it is abundant. Its interest to the scientist lies in its being a fresh-water representative of the cod family.

Its range is from New England and Great Lakes region north to the Arctic Seas and west to the head waters of the Missouri, the Frazer River basin, and Behring Straight. In Maine it is reported from the Presumscot, Androscoggin, Kennebec, Penobscot and St. John River Basins.

A specimen about 14" long was caught Jan 22 1933 in Pushaw Pond. DBG

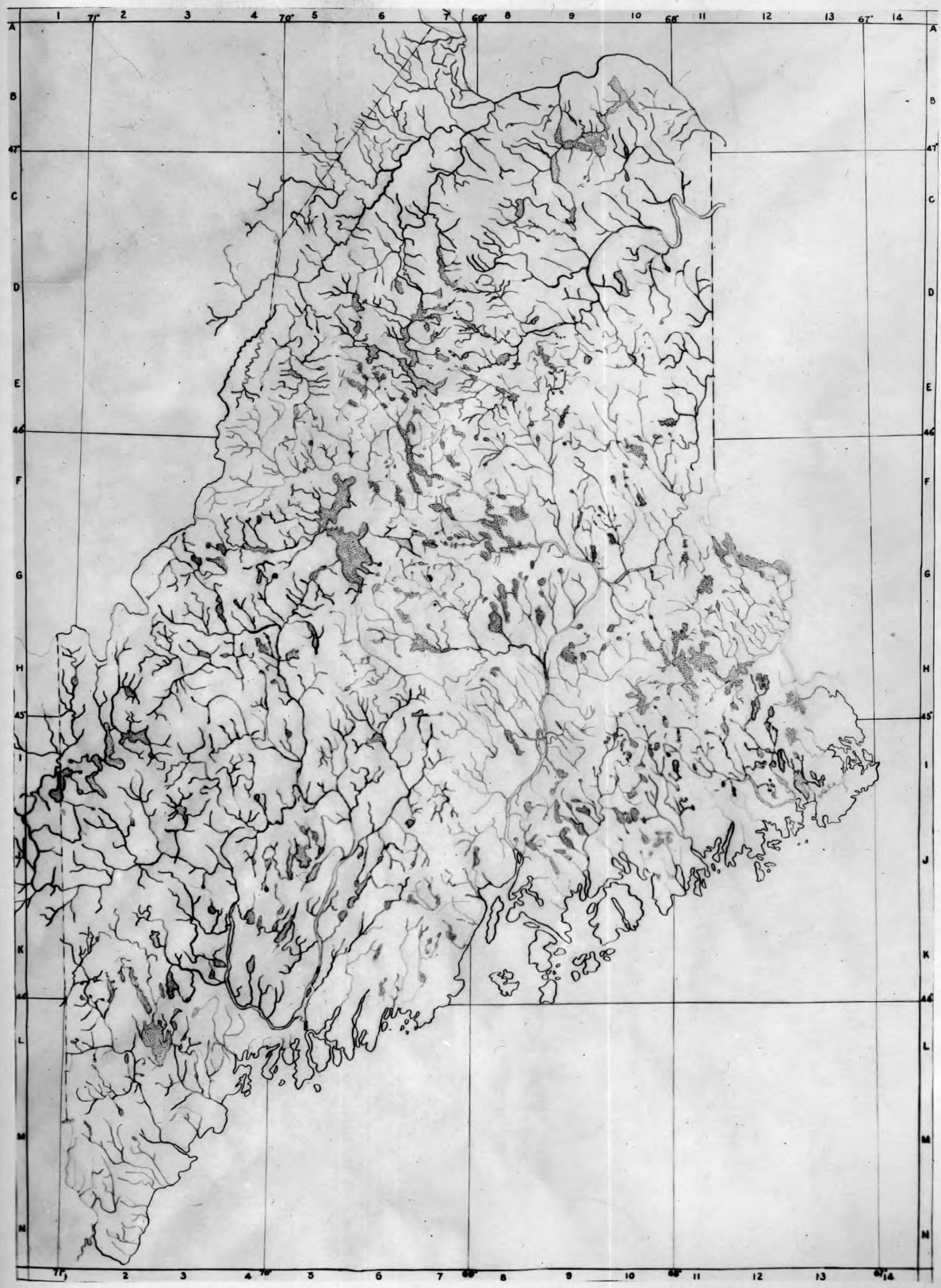
Several specimens caught in the Stillwater river near the University of Maine Campus during the third week in February, 1934. The largest was about 18" long. Five minnows were used for bait and some of the cusk apparently bit at night. R.S. Palmer

Recorded Natural Distribution of Native Fresh-Water Fishes of Maine By Principal River Basins.

Maine Fresh-Water Fishes	Presumpscot	Royals	Androscoggin	Kennebec	Penobscot	Union	St. Croix	St. John. Aroostook	St. John. Fish River	St. John. St. Francis	St. John. Allagash above the falls.
1. Ameiurus nebulosus	x		x	x	x	x	x		x	x	x
2. Erimyzon oblongus	x										
3. Catostomus catostomus			x		x		?		x	x	
4. Catostomus commersonii	x	x	x	x	x	x	x		x	x	x
5. Pimephales anuli					x					x	
6. Chrosomus erythrogaster		x		x	x				x		
7. Semotilus bullaris	x	x	x	x	x	x	x		x	x	x
8. Semotilus atromaculatus		x	x	x	x	x			x		x
9. Leuciscus carletoni					x				x		
10. Phoxinus neogaeus			x		x				x		x
11. Abramis crysoleucas	x		x	x	x		x		x		
12. Notropis bifrenatus	x										
13. Notropis kendalli					x				x		
14. Notropis cornutus	x	x	x	x	x	x	x		x	x	x
15. Rhinichthys atronasus	x	x	x	x	x		x		x		x
16. Couesius plumbeus	x	x	x	x	x				x	x	x
17. Anguilla rostrata	x	x	x	x	x		x				
18. Coregonus quadrilateralis				x					x	x	x
19. Coregonus labradoricus	x			x		x			x	x	x
20. Coregonus stanleyi									x	x	x ?
21. Salmo sebago	x				x	x	x				
22. Salvelinus namaycush			x	x	x		x		x	x	x
23. Salvelinus fontinalis	x	x	x	x	x	x	x	x	x	x	x
24. Salvelinus oquassa			x		x						
25. Salvelinus aureolus						x					
26. Osmerus mordax	x	x	x	x	x	x	x				
27. Osmerus spectrum				x							
28. Osmerus abbottii				x							
29. Fundulus diaphanus			x	x	x	x	x		x		
30. Esox reticulatus	x	x	x	x	x	x	x				
31. Eucalia inconstans				x							
32. Pungitius pungitius	x	x			x		x		x		
33. Gasterosteus atkinsii			x	x	x	x	x		x	x	x
34. Lepomis auritus			x	x	x						
35. Lepomis gibbosus	x		x	x			x				
36. Micropterus dolomieu	x	x	x	x	x		x				
37. Perca flavescens	x		x	x	x	x	x			x	
38. Morone americana	x		x	x	x		x				
39. Cottus gracilis	x		x		x			x	x	x	x
40. Lota maculosa	x		x	x	x				x	x	x

Key to Map.
Rivers, Lakes, and Ponds

Presumscot River	L3
Long Pond	K2
Sebago Lake	L2
Little Sebago Lake	L3
Royals River	L4
Androscoggin River	K4
Thompson Lake	K3
Rangeley Lakes	I2
Umbagog Lake	I1
Lower Richardson	I2
Upper Richardson	I2
Mooselookmeguntic	I2
Rangeley	I2
Kennebago	H2
Kennebec River	K5
Belgrade Lakes	J5
Long Pond	
Great Pond	
Snow Pond	
Moose and Indian Ponds	I6
Moosehead Lake	F5
Penobscot River	H9
Allamoosook Lake	J8
Toddy Pond	J9
Sebec Lake	H6
Schoodic Lake	G8
Sebois Lake	G8
Nicatous Lake	H10
Cold Stream Pond	H9
Millinocket Lake	F8
Chesuncook Lake	F6
Union River	J9
Branch Pond	J9
Green Lake	J9
St. Croix River	G12
Western Schoodic Lakes	H11
Sysladobsis Lake	
Grand Lake	
Big Lake	
Eastern Schoodic Lakes	G12
Grand Lake	
Chiputneticook Lakes	
St. John River	C6
Allagash River	C7
Allagash Lake	E6
Chamberlain Lake	E7
Fish River	C9
Eagle Lakes	B9
Upper Lake	C9
Eagle Lake	B9
Square Lake	B9
Cross Lake	B9
Long Lake	B10
Aroostook River	C10
Millinocket Lake	E8
Squapan Lake	D10
St. Francis River	A7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Distribution of Fish and Fish Eggs.

	eggs or fish
1873.	
Quinnot salmon	5,000
Landlocked "	2,000
Atlantic "	154,750
Shad	100,000
1874.	
Quinnot salmon	30,000
Atlantic "	228,613
Shad	300,000
1875.	
Landlocked salmon	250,000
Atlantic "	209,000
Shad	100,000
1876.	
Landlocked salmon	110,000
Atlantic "	320,000
1877.	
Landlocked salmon	497,200
Shad	85,000
1878.	
Quinnot salmon	12,700
Landlocked "	449,500

1879.- none

1880.

	fish
Atlantic salmon.	
Streams:	
Penobscot, Saco, Kennebec, Androscoggin, Machias, Denny's and Presumpscot Rivers	529,356
Landlocked salmon	fish
Phillips & Bangor	64,000
Shad	fish
Kennebec, Mattawamkeag	675,000
German carp	fish
4 localities	75

1881.

1. Atlantic salmon	eggs
C. G. Atkins, Grand Lake Stream	50,000
2. Landlocked salmon (schoodic)	
A. J. Darling, Enfield	5,000
3. Shad	fish
Kennebec, Mattawamkeag	1,150,000
4. Carp	fish
6 applicants in Maine	116

1889-90.

Carp	Eggs	Fry	Adults & Yearlings
Applicants in Maine	-	-	70
Atlantic salmon	40,000	-	91,395
Landlocked salmon (total)	135,000	364,000	17,380
Von Behr trout			
U. S. Fish Commission, Craig Brook	9,000	-	-
Brook trout			
Meadow Brook, Orland			250
Craig Brook, Orland			772
Saibling			
U. S. Fish Commission, Craig Brook	4,000		

1890-91.

Atlantic salmon			
Tributaries of Penobscot R, Craig Brook	-	-	103,506
Loch Leven trout			
U. S. Fish Commission, Craig Brook	20,000	-	-
Von Behr trout			
Great Brook, Green Lake	-	-	3,413
Heart Pond, Orland	-	-	167
Brook trout			
Moose Pond, Hartland	-	4,251	-

1891-92

	Eggs	Fry	Adults & Yearlings
Atlantic salmon	-	-	254,232
Landlocked salmon	-	68,692	148,163
Loch Leven trout			
Toddy Pond, Craig Brook Station			10,935
Rainbow trout			
Heart Pond, Orland			105
Little Cold River, Fryeburg			500
Von Behr or brown trout			
Toddy Pond, Orland			743
Brook trout			
Craig Pond, Orland			1,479
Alamoosook Lake, East Orland			198

1893.

Carp	
Applicants in Maine	150
Goldfish	
Applicants in Maine	8
Atlantic salmon	
Alamoosook Lake, Craig Brook	1,448
Landlocked salmon	65,521
Brook trout	29,534

1893-94.

	Eggs	Fry	Adults & Yearlings
1. Carp,			
Applicants in Maine	-	-	30
2. Goldfish			
Applicants in Maine	-	-	14
3. Atlantic salmon (total)			235,306
4. Landlocked salmon (total	10,000	6,000	130,058
5. Loch Leven trout			
Floods Pond, Hancock County			2,500
Big Tunk Pond, Ellsworth			4,000
Green Lake, Hancock County			11,668
Simmons Pond, Ellsworth			500
Branch Pond, East Dedham			2,000
Heart Pond, East Orland			46
Total			20,714
6. Rainbow trout			
Green Lake, Hancock County	-	500	-
Parlin Pond, Somerset County	-	-	300
7. Von Behr trout			
Big Tunk Pond, Ellsworth	-	-	3,000
Phillips Pond, Phillips Pond Station	-	-	2,000
Rocky Pond, Hancock County	-	-	3
Branch Pond, East Dedham	-	-	4,228

Green Lake, Hancock County	-	-	3
Pattens Pond, " "	-	-	5
Rogers Pond, Topsham	-	-	400
Heart Pond, Orland	-	-	18
Lidensparker Pond, Waldoboro-		-	1,500
Fourth Pond, Hancock County	-	-	2,000
Total			24,146

8. Brook trout

Craig Pond, East Orland			4,505

9. Lake trout

Green Lake, Hancock County	-	25,000	-
Heart Pond, East Orland	-	-	19
East Orland	-	-	17
Total		25,000	36

1894-95.

Atlantic salmon			186,241
Landlocked salmon (total)	-	-	101,256

Loch Leven Trout

Onawa Lake, Monson	500
Morancy Pond, Sorrento	1,000
Rowe Pond, Bingham	500
City Reservoir, Belfast	500
Seal Cove Pond, Tremont	1,000
Branch Pond, Ellsworth	250
Winkempaugh Brook, East Dedham	1,750

Floods Pond, Floods Pond			3,000
Spitical Pond, Aurora			4,000
Applicants in Maine			12
Total			12,512
Von Behr trout			
Branch Pond, Ellsworth			2,000
Applicants in Maine			614
Total			2,614
Rainbow trout			
Great Brook, Green Lake	-	350	-
Brook trout (total)			600

1896.

1.Carp	Eggs	Fry	Adults & Yearlings.
Applicants in Maine	-	-	30
2.Atlantic salmon	-	-	151,676
3.Landlocked salmon (total)	-	59,525	34,482
4.Steelhead trout			
Pleasant River, Brownville	-	6,433	-
Todd Brook, Brownville	-	4,800	-
Salmon Brook, Sebec	-	5,200	-
Baker Brook, Milford	-	2,000	-
Brick Stream, "	-	2,000	-
Sunkhaze Stream, Greenfield	-	1,951	-
Burnt Bridge Brook, Enfield	-	1,600	-

Darling Pond, Enfield	-	1000	-
Webb Brook, Lowell	-	10000	-
Moosehorn Stream, Bucksport	-	1600	-
Smith Brook, Hancock County	-	1600	-
Brook near New Boston, "	-	3747	-
Comstock & Meduxnikeag Rivers, Caribou	-	1976	-
Total		43907	
5. Rainbow trout			
Great Brook, Green Lake	-	-	48
6. Brook trout (total)	40,000	24,565	16,913
7. Lake trout			
Sweets Pond, Farmington	-	-	1,000
8. Golden trout			
Green Lake, Ellsworth	-	10,200	-
Flood Pond, Otis	-	11,500	-
Great Brook, Green Lake	-	-	10
Total		21,700	10
9. Scotch sea trout	-		
Craig Pond, Orland		-	1,376

1897

	Eggs	Fry	Adults & Yearlings.
1. Quinnot salmon			
Maine Fish Commission, Monmouth	5,000	-	-
Commodore Club, Hartland	25,000	-	-

Williams Brook, Bucksport	-	19,995	3,597
Heart Pond, Orland	-	-	2,892
Toddy Pond, Orland	-	7,994	513
Branch Pond Stream, Ellsworth Falls	-	420,000	-
Union River " "	-	379,500	-
Pattens Pond Stream "	-	95,000	-
Penobscot River, Brewer	-	12,500	-
" " Milford	-	51,690	-
" " Costigan	-	53,400	-
" " Greenbush	-	29,400	-
" " Passadumkeag	-	106,800	-
" " Lincoln Center	-	77,400	-
" " Winn	-	106,800	-
" " Mattawamkeag	-	192,010	-
Meadow Brook, Orland	-	22,200	-
Lake Cochnewagon, Monmouth	-	50,000	-
Pert Stream, Orland	-	11,998	-
Alamoosook Lake, Orland	-	15,249	196
Pleasant River, Milo Junction	-	30,000	-
Pleasant River, Milo	-	30,000	-
" " Brownville	-	30,000	-
" " " Junction	-	15,000	-
" " Katahdin Iron Works	-	54,000	-
Total	30,000	1,810,936	7,198

2. Atlantic salmon (total)	40,000	1,655,671	234,799
3. Landlocked salmon (total)	20,000	61,000	11,050
4. Steelhead trout			
Turner Pond, Isle au Haut	-	-	3,090
Silver Lake, Katahdin Iron Works	-	25,000	-
Smith Brook, Bucksport	-	24,989	-
Craig Brook, Orland	-	2,000	-
Heart Pond, Orland	-	3,756	1,700
Craig Pond, Orland	-	-	1,800
Tributaries of Hothole Pond, Orland	-	-	1,662
Long Pond, Bucksport	-	-	2,093
State Fish Commission, East Auburn	-	-	200
Total		55,745	10,545
5. Rainbow trout			
Applicants in Maine	-	-	281
Cargill Pond, Thorndike	-	-	1,000
Alamoosook Lake, Orland	-	-	6,121
Total			7,402
6. Von Behr trout			
State Fish Commission, Holden	-	-	569
7. Brook trout (total)	30,000	50,000	519
8. Lake trout			
Alamoosook Lake, Orland	-	-	3,211

9. Swiss lake trout

Moose Pond, Hartland	--	--	3,600
Philips Lake & Holbrook Pond, Bangor	--	--	3,400
Nicatous Lake, Enfield	--	--	1,937
Alamoosook Lake, Orland	--	--	10,045
Total			18,982

10. Golden trout

State Fish Commission, Monmouth	10,000	--	--
Winkempaugh Brook, Hancock County	--	15,000	--
Floods Pond, Ellsworth Falls	--	20,000	--
Totals	10,000	35,000	

11. Black bass, large mouth

Forbes Pond, Sullivan	--	--	500

1898.

1. Quinnot salmon	Eggs	Fry	Adults & Yearlings.
Long Pond, Bucksport	--	--	29,691
Penobscot R. Orrington	--	--	17,182
" tributary, Prospect	--	--	6,747
Brewer Pond, Bucksport	--	--	19,982
Penobscot R., Milford	--	--	4,994
" " Bradley	--	--	9,994
Sweet Pond, Orrington	--	--	5,000

Penobscot R. Eddington	—	—	7,485
" " Brewer	—	—	20,423
" " N. Milford	—	—	2,493
Alamoosook Lake, Orland	—	—	65,896
Toddy Pond, Surry,	—	—	27,816
Hancock P. Bucksport	—	—	2,799
Heart Pond, Orland	—	—	6,066
Toddy Pond, Orland	—	—	3,032
Craig Pond, Orland	—	—	200
Me. Fish Comm. Monmouth	35,000	—	—
C.E.Oak, Caribou	15,000	—	—
Union R. Ellsworth	—	901,066	—
Total	50,000	901,066	229,800
2. Atlantic Salmon (total)		1,975,068	220,335
3. Landlocked salmon (total)	66,243	—	79,990
4. Steelhead trout			
Commodore Club,Hartland	50,000	—	—
Alamoosook Lake, Orland	—	10,032	6,172
Tributaries of Great Brook, Otis	—	8,700	—
Abraham & Molasses Ponds, Eastbrook	—	14,266	—
Toddy Pond, Surry	—	19,709	—
Craig Pond, Orland	—	2,200	—
Heart Pond, Orland	—	4,000	—
Total	50,000	58,907	6,172

5. Rainbow trout			
Alamoosook Lake, Orland	--	--	355
6. Brook trout (total)	25,000	356,721	--
7. Lake trout			
State Fish Comm. Enfield	75,000	--	--
Rocky Pond, Otis	--	15,000	--
Phillips Pond, Dedham	--	30,000	--
Applicants in Maine	--	10,000	--
Green Lake, Ellsworth	--	998	--
Total	75,000	55,998	--
8. Scotch Sea Trout			
Alamoosook Lake, Orland	--	--	1,489
9. Golden Trout			
Tributaries of Great Brook, Otis	--	20,000	--
Alligator Lake, Ellsworth Falls	--	7,000	--
Holbrook Pond, Holden	--	7,000	--
Branch Pond, Dedham	--	20,000	--
Flood Pond, Otis	--	18,144	--
State Fish Commission, Monmouth	10,000	--	--
" " " Auburn	--	7,000	--
Total	10,000	79,144	--

1899.

	Eggs	Fry & Fingerlings	Adults & Yearlings.
1. Atlantic salmon (total)	-	445,000	392,257
2. Landlocked salmon (total)	62,500	141,875	451,682
3. Steelhead trout			
State Fish Commission, Bangor			100
Alligator Lake, Great Pond			1,000
Jordan Pond, Northeast Harbor			500
Green Lake, Otis			2,667
Heart Pond, Orland			4,151
Craig Pond, Orland			4,194
Alamoosook Lake, Orland			4,218
Toddy Pond, Orland			6,679
Surry			6,706
Total			30,195
4. Rainbow trout			
Swan Lake, Belfast			2,000
Jordan Pond, Northeast Harbor			500
Lake Pennesseewassei, Norway			1
Canaan Lake, Camden			2
Heart Pond, Orland			2
Alamoosook Lake, Orland			5,862
Craig Pond, Orland			1,500
Toddy Pond, Orland			2,395
Total			17,257

5. Black-spotted trout			
Rocky Pond, Otis	-	8,386	-
6. Brook trout (total)	-	196,000	8,800
7. Lake trout			
Donnell Pond, Franklin	-	15,000	-
Lake Thompson, Oxford	-	15,000	-
Sand Pond, Farmington	-	15,000	-
Branch Pond, Dedham	-	45,000	-
Rocky Pond, Dedham	-	45,000	-
Phillips Lake, Dedham	-	45,000	-
Holbrook Pond, Holden	-	45,000	-
Little Fitz Pond, Holden	-	30,000	-
Tunk Pond, Sullivan	-	45,000	-
Green Lake, Otis	-	34,317	-
Patten Pond, Ellsworth	-	45,000	-
State Fish Commission, Enfield	500,000	-	-
Total	500,000	379,317	-
8. Scotch sea trout			
Heart Pond, Orland	-	-	742
Alamoosook Lake, Orland	-	-	22
Total			764
9. Golden trout			
Phillips Lake, Dedham	-	1,500	-
Green Lake, Otis	-	1,574	-

1900.

	Eggs	Fry & Fingerlings	Adults & Yearlings.
1. Atlantic salmon		908,073	541,858
2. Landlocked salmon (total)	30,000	10,000	450,052
3. Steelhead trout			
Cobbosseecontee Lake, Winthrop	-	2,800	-
Billings Pond, Bluehill	-	3,000	-
Canaan Lake, Rockland	-	2,500	-
Rocky Pond, Otis	-	-	3,653
Alamoosook Lake, Orland	-	-	226
Total		8,300	3,879
4. Rainbow trout			
Onawa Lake, Greenville	-	1,000	-
Canaan Lake, Rockland	-	800	-
Long Pond, Somesville	-	1,000	-
Alamoosook Lake, Orland	-	-	9
Total		2,800	9
5. Brook trout (total)	318,222	5,210	-
6. Lake trout			
State Fish Commission, Enfield	350,000	-	-
Donnell Pond, Franklin	-	55,000	-
Long Pond, Great Pond	-	40,000	-
Morrison Lake, Green Lake	-	20,000	-

Rocky Pond, Otis	-	45,000	-
Green Lake, Otis	-	21,000	-
Holbrook Pond, Holden	-	45,000	-
Little Fitz Pond, Holden	-	45,000	-
Phillips Lake, Dedham	-	45,000	-
Tunk Pond, Sullivan	-	40,000	-
Schoodic Lake, Schoodic	-	150,000	-
Belgrade Lake, Belgrade	-	41,000	-
Messalonskee Lake, Belgrade	-	40,000	-
Total	350,000	587,000	-
7. Scotch Sea trout			
Heart Pond, Orland	-	-	5,266
Toddy Pond, Orland	-	-	248
Patten Pond, Orland	-	-	18,899
Ellsworth	-	20,000	27,234
Lond Pond, Bar Harbor	-	7,000	-
Total		27,000	51,647
8. Golden trout			
Harriman Pond, Dedham	-	6,990	-

1901.

	Eggs	Fry & Fingerlings	Adults & Yearlings.
1. Atlantic salmon (total)	-	10,000	182,620
2. Landlocked salmon (total)	20,855	359,923	186,009
3. Steelhead trout			
Morrison Lake, Ellsworth Falls	-	-	2,000
Phillips Lake, Lakehouse	-	5,000	5,000
Alamoosook Lake, East Orland	-	-	5,172
Green Lake, Otis	-	-	1,370
Total		5,000	13,542
4. Brook trout (total)	-	437,529	-
5. Lake trout			
First Debsconeag Lake, Norcross	-	10,000	-
Second " " "	-	10,000	-
Morrison Pond, Dedham	-	9,827	-
Phillips Lake, Dedham	-	150,000	-
Green Lake, Dedham	-	50,000	-
Tunk Pond, Franklin	-	100,000	-
Maine Fish Commission, Enfield	358,500	-	-
Total	358,500	329,827	-

1902-3.

	Eggs	Fry & Fingerlings	Adults & Yearlings.
1. Atlantic salmon	-	48,715	282,000
2. Landlocked salmon (total)	20,000	519,785	74,591
3. Steelhead trout			
Lake Cobbosseecontee, Monmouth	-	12,046	-
4. Rainbow trout			
Canaan Lake, Camden	-	-	500
Lake Penneesswasswee, Norway	-	-	406
Phillips Lake, Bangor	-	-	500
5. Brook trout (total)	550,000	1,080,863	16,643
6. Scotch sea trout			
Phillips Lake, Bangor	-	-	3,000
Craig Pond, East Orland	-	-	3,837
Alamoosook Lake, Orland	-	7,694	-
Total		7,694	6,837
7. Grayling			
Heart Pond, Orland	-	17,822	-
Craig Pond, Orland	-	17,761	-
Craig Brook, Orland	-	750	-
Total		36,333	

1903.

	Eggs	Fry	Fingerlings Yearlings & Adults
1. Atlantic salmon (total)	-	1,582,409	303,414
2. Landlocked salmon (total)	70,000	196,122	370,550
3. Steelhead trout			
Dead River, Orland	-	5,582	-
Alamoosook Lake, East Orland	-	-	353
4. Brook trout (total)	350,000	860,000	115,137
5. Scotch sea trout			
Heart Pond, East Orland	-	-	52
Craig Pond, East Orland	-	-	35
Toddy Pond, East Orland	-	-	75
Total			162
Grayling			
Floods Creek, Surry	-	3,300	-
Dead Brook, Bucksport	-	3,314	-
Moosehorn Creek, Bucksport	-	4,000	-
Phillips Lake, Lakehouse	-	6,500	-
Total		17,114	

1904.

	Eggs	Fry	Fingerlings Yearlings & Adults
1. Quinnot salmon			
State Fish Commission, Winthrop	100,000		
2. Atlantic salmon	-	4,066,716	349,000
3. Landlocked salmon (total)	25,000	18,000	251,622
4. Steelhead trout			
State Fish Commission, Monmouth	20,000	-	-
5. Rainbow trout			
Canaan Lake, Rockland	-	-	747
6. Brook trout (total)	-	1,250,030	70,300
7. Golden trout			
Canaan Lake, Rockland	-	5,000	-
Norters Lake, Rockland	-	5,000	-
Moostocmaguntic Lake, Oquossoc-		5,000	-
China Lake, Waterville	-	5,000	-
Total		20,000	
8. Black bass (large-mouth)			
Lower Kimball Pond, Fryeburg	-	-	348

1905.

	Eggs	Fry	Fingerlings Yearlings & Adults.
1. Silver salmon			
Brownville, Penobscot River	-	228,700	-
Bucksport, inlet to Hancock Pond	-	2,250	-
outlet to Jacob Back	-	3,750	-
Stubbs Brook	-	6,000	-
Cherryfield, Narragaugus R.	-	50,000	-
Damariscotta Mills, Damariscotta River	-	88,000	-
Dennysville, Denny's River	-	125,700	-
East Bucksport, Copeland Brook	-	16,000	-
East Orland, Alamoosook Lake	-	33,738	-
Heart Pond	-	5,000	-
Toddy Pond	-	19,111	-
tributary of Patten Pond	-	10,215	-
Ellsworth Falls, Union River	-	50,236	-
Freeport, Spar Creek	2,000	-	-
Newport, Sebasticook R.	-	142,800	-
Presque Isle, Aroostook R.	-	88,000	-
Saco, Saco River	-	54,600	-
Surry, Toddy Pond	-	19,587	-
Union, Seven Tree Pond	-	10,000	-

	Vanceboro, St. Croix R.	-	114,700	-
	Vassalboro, Kennebec R.	-	169,000	-
	Maine Fish Commission, Winthrop	55,000	-	-
2.	Steelhead trout			
	Augusta, Lake Cobbosseecontee	-	-	4,370
	Rockland, Moody Pond	-	-	4,370
3.	Rainbow trout			
	East Orland, Alamoosook Lake	-	-	1,207
	Monmouth, Lake Cobbosseecontee	-	-	2,000
	Otis, Green Lake	-	-	18,545
4.	Atlantic salmon	3,000	727,462	289,102
5.	Landlocked salmon	70,000	242,011	124,077
6.	Scotch sea trout			
	East Orland, Alamoosook Lake	-	-	3,479
7.	Lake trout			
	Farmington, Varnums Pond	-	20,000	-
	Fryeburg, Lake Kegar	-	20,000	-
8.	Brook trout (total)	50,000	1,145,696	37,571
9.	Large-mouth black bass			
	Poland, Range Ponds	-	-	300

1906.

	Eggs	Fry	Fingerlings Yearlings & Adults
1. Shad			
Augusta, Kennebec River		964,800	
Swan Island, " "		38,400	
2. Silver salmon			
East Orland, Alamoosook Lake	-	-	3,000
Craig Pond	-	-	1,000
Heart Pond	-	-	1,000
Toddy Pond	-	-	3,000
3. Humpback salmon			
Brunswick, Androscoggin River		75,000	
Bucksport, Dead Brook		20,000	
Harriman's Brook		5,000	
Hurd's Brook		5,000	
Kent's Brook		1,400	
Smelt Brook		8,900	
Wasson's Brook		1,400	
East Orland, Alamoosook Lake		40,000	
Craig Brook		5,000	
Heart Pond		5,000	
Ellsworth, Union River		50,000	
Gardiner, Kennebec River		50,000	
Hallowell, Kennebec River		75,000	

Orland, Leaches Brook	-	1,425	-
Narramissic River	-	45,000	-
Orland River	-	32,500	-
Phillips Brook	-	10,000	-
Saunders Brook	-	1,400	-
Stovers Brook	-	1,425	-
Penobscot, Pierce's Creek	-	25,000	-
So. Orrington, Mill Creek	-	12,564	-
Penobscot River	-	12,500	-
Surry, Patten Brook	-	25,000	-
Waterville, Kennebec River	-	50,000	-
4. Rainbow trout			
East Orland, Craig Pond	-	-	48
5. Atlantic salmon	-	1,897,607	79,317
6. Landlocked salmon (total)	100,000	458,500	28,142
7. Scotch sea trout			
East Orland, Alamoosook Lake	-	-	504
8. Lake trout			
East Orland, Toddy Pond	-	-	246
Monmouth, Me. Fish Comm.	200,000	-	-
Newport, Lake Sebasticook	-	25,000	-
9. Brook trout	300,000	1,175,500	114,045
10. Small-mouth black bass			
Fryeburg, Lovells Pond	-	-	200
Poland, Range Ponds	-	-	250

11.Large-mouth black bass	-	-	
Poland, Range ponds	-	-	250
12.Pike perch			
North Belgrade, Maine Fish Commission	1,500,000	-	-
13.White perch			
Readfield, Parker's pond	-	135,000	-

1907.

	Eggs	Fry	Fingerlings Yearlings & Adults
1. Humpback salmon			
Bucksport, Dead Brook			600
East Orland, Alamoosook	-	-	8,519
East Orland, Craig Brook	-	-	1,284
East Orland, Heart Pond	-	-	1,238
Total			11,641
2. Steelhead trout			
Newcastle, Viscay Pond		7,500	
Pemaquid		7,500	
3. Atlantic salmon			
Brownville, Pleasant River			38,830
Penobscot County, Penobscot R.		2,156,852	
4. Landlocked salmon (total)	85,000	123,719	223,889
5. Lake trout			
Chapman's Landing, Green Lake		71,012	
East Wilton, Pease Pond		10,000	
Hartland, Moose Pond		15,000	
Monmouth, Maine Fish Comm.	200,000		
6. Brook trout (total)	105,737	1076,772	118,570
7. White perch			
North Berwick, Bannegg. Beg Pond		400,000	

1908.

	Eggs	Fry	Fingerlings Yearlings & Adults
1. Landlocked salmon	115,000	329,032	113,725
2. Humpback salmon	-	-	-
Augusta, Kennebec R.	-	43,750	-
Brunswick, Androscoggin R.	-	81,250	-
Bucksport, Dead Brook	-	10,000	-
Small Brooks	-	10,000	-
East Orland, Alamoosook Lake	-	25,986	-
North Bucksport, Hurd'sBrook	-	10,000	-
Old Town, Penobscot River	-	100,000	-
Orland, Orland River	-	20,000	-
Phillips Brook	-	7,500	-
Stover's Brook	-	2,500	-
South Orrington, Mill Creek	-	10,000	-
Waterville, Kennebec River	-	100,000	-
Total		420,986	
3. Lake trout			
Dedham, Green Lake	-	60,000	-
East Wilton, Pease Pond	-	12,500	-
Farmington, Varnum's Pond	-	12,500	-
Hartland, Moose Pond	-	14,259	-
Morrill Pond	-	14,260	-
Skowhegan, Lake George	-	26,481	-
Total		140,000	

4. Brook trout	-	1,304,439	63,611
5. Small-mouth Black Bass			
Holden, Holbrook's Pond	-	10,000	-
6. Large-mouth black bass			
Belgrade Lakes, Great Lake-		-	684
7. White perch			
Monmouth, Maine Fish Comm.			
		700,000	- -

1909.

	Eggs	Fry	Fingerlings Yearlings & Adults.
1. Rainbow trout			
Northeast Harbor, Upper Hadlock Pond	-	7,400	-
2. Atlantic salmon			
Mattawamkeag, Penobscot R.		-	24,430
Penobscot County, Little Spring Brook		50,000	-
Penobscot River		597,790	-
		647,790	24,430
3. Landlocked salmon	400,000	758,305	215,276
4. Lake trout	-	492,000	-
5. Brook trout	300,000	149,737	97,800
6. Scotch sea trout			
East Orland, Alamoosook Lake		-	47
7. Small-mouth Black bass			
Belgrade, Great Pond	-	1,900	-
Danville Jct., Tupp's Pond	-	1,900	
Total		3,800	
8. Smelt			
Otis, Green Lake		-9400,000	

1910.

	Eggs	Fry	Fingerlings Yearlings & Adults.
1. Atlantic salmon	-	1,217,366	228,052
2. Landlocked salmon	-	956,540	229,164
3. Lake trout			
Bridgton, Highland Lake-		11,000	-
Cherryfield, Mopang " -		11,000	-
East Wilton, Pease Pond-		11,000	-
Green Lake, Green Lake -		263,922	-
North Anson, Great Embden -		11,000	-
Readfield, Parker's Pond-		11,000	-
Skowhegan, Lake George -		10,000	-
Unity, Unity Pond -		11,000	-
Total		339,922	
4. Brook trout (total)	25,000	1,297,500	62,050
5. Small-mouth black bass			
Fryeburg, Kezar Pond -		1,600	-
Winthrop, Lake Annabessacook-		1,500	-
Lake Maronocook-		4,500	-
Total		7,600	

1912.

	Eggs	Fry	Fingerlings Yearlings & Adults.
1. Rainbow trout			
Bingham, Little Chase Pond	-	-	2,000
Scarboro Beach, Mossacre Pond	-	-	2,000
2. Atlantic salmon		1,841,221	22,711
3. Landlocked salmon	75,000	284,454	70,037
4. Lake trout			
Farmington, Clearwater Pond	-	15,000	-
Locke's Mill, South Pond	-	10,000	-
Perry, Boyden's Lake	-	15,000	-
Unity, Unity Pond	-	-	1,500
Total		40,000	1,500
5. Brook trout	100,000	1,374,938	76,650
6. Scotch sea trout			
East Orland, Craig Pond			3,800
East Orland, Heart Pond			6,772
Total			10,572
7. Small-mouth black bass			
Belgrade, Long Lake	-	2,000	-
Bridgton, Highland Lake	-	2,000	-
Kittery Jct. Folly Pond	-	1,500	-
Waldoboro, Medomak R.	-	2,000	-
Total		7,500	

8. White perch

North Berwick, Banneg Beg Lake	-	1,000,000	-
Walker, Squawpan Lake	-	2,500,000	-
Total		3,500,000	

9. Smelt

Otis, Green Lake	-	6,575,000	-

1913.

	Eggs	Fry	Fingerlings Yearlings & Adults
1. Catfish			
Norway, Mud Pond	-	-	150
2. Silver salmon			
Brownville, Pleasant River			45,800
Grindstone, Penobscot River			24,000
Total			69,950
3. Atlantic salmon (total)		3,492,464	4,304
4. Landlocked salmon (total)	100,000	231,146	65,996
5. Lake trout			
Bryant Pond, Lake Christopher-		10,600	-
Farmington, Varnum Lake	-	5,000	-
Franklin, Donnell's Pond	-	8,000	-
Jackman, Clear Water Pond	-	5,000	-
Onawa, Lake Onawa	-	10,000	-
Total		38,600	
6. Brook trout (total)	100,000	1,603,335	77,290
7. Small-mouth black bass			
Ayers Jct. Meddybemps Lake-		1,200	-
Oakland, Little Pond	-	1,200	-
Sherman Sta. Salmon Stream Lake-		1,200	-
Total		3,600	

8. White perch

Bar Mills, Eagles Pond	-	-	400,000
North Berwick, Eel Pond	-	-	300,000
Total			700,000

9. Smelt

Green Lake, Green Lake	-	-	500,000
Otis, Green Lake	-	-	1,350,000
Total			1,850,000

1914.

	Eggs	Fry	Fingerlings Yearlings & Adults.
1. Humpback salmon			
Bangor, Penobscot R.	-	236,250	-
Brunswick, Androscoggin R.	-	225,000	-
Bucksport, Harriman Brook	-	92,000	-
Smelt Brook	-	196,000	-
Bucksport Ctr. Penobscot R.	-	464,000	-
Riches Brook	-	198,000	-
Columbia Falls, Pleasant R.	-	1054,000	-
Damariscotta Mills, Damariscotta R.	-	1056,000	-
Dennysville, Denny's R.	-	225,000	-
East Orland, Alamoosook Lake	-	75,000	-
Orland R.	-	16,000	-
Ellsworth, Union River	-	226,600	30,000
Orland, Orland River	-	1716,072	-
Penobscot, Pierce Pond	-	28,000	-
Snowmans Pond	-	104,000	-
Princeton, St. Croix R.	-	300,000	-
St. Croix R. West Br.		225,000	-
South Penobscot, Whites Pond	-	28,000	-
Waldoboro, Medomak River	-	352,000	-
Warren, Georges River	-	352,000	-
Total		7,168,322	30,000

2.	Rainbow trout			
	Eagle Lake, Cross Lake	-	-	3,000
	Square Lake	-	-	2,400
	East Orland, Craig Pond	-	-	94
	Pembroke, Pennamaquan Lake	-	-	3,000
	Total			8,494
3.	Atlantic salmon			
	East Bucksport, Penobscot R.	-	241,512	-
	East Orland, Alamoosook Lake	-	-	16,993
	Penobscot River	-	2,331,783	-
	Total		2,573,295	16,993
4.	Landlocked salmon (total)	100,000	312,486	2,845,997
5.	Scotch sea trout			
	East Orland, Alamoosook Lake	-	-	10,000
	Craig Pond	-	-	2,454
	Toddy Pond	-	-	7,942
	Total			20,396
6.	Lake trout			
	Bridgton, Highland Head	-	-	6,000
	Moose Pond	-	-	6,000
	Woods Pond	-	-	6,000
	Byron, Garland Pond	-	-	12,000
	Dedham, Phillips Lake	-	-	25,000
	Enfield, State Fish Comm.	50,000	-	-
	Farmington, Varnum's Pond	-	-	6,000

Jackman, Lake Wood	-	-	6,000
LaGrange, Boyd Lake	-	-	9,000
Onawa, Onawa Lake	-	-	7,500
Otis, Green Lake	-	-	5,653
Total	50,000		89,153
7. Brook trout (total)		45,000	317,415
8. Smelt			
Green Lake, Green Lake	-	3,775,000	-
9. Small-mouth black bass			
Augusta, Lake Cobbosseecontee	-	4,000	-
North Bridgton, Long Lake	-	4,000	-
10. Large-mouth black bass			
Livermore Falls, David's Pond	-	-	80
11. White perch			
Brooks, Randall Lake	-	500,000	-
Fryeburg, Lovewells Pond	-	400,000	-
Norway, Kezar Lakes	-	400,000	-
Lake Keenaydin	-	700,000	-
Lake Pennesseemassee	-	600,000	-
Virginia Lake	-	700,000	-
Old Town, Pickerel Pond	-	300,000	-
Walker, Squa Pan Lake	-	700,000	-
West Paris, Big Concord Pond	-	330,000	-
Pleasant Pond	-	330,000	-
Total		4,960,000	

1915.

	Eggs	Fry	Fingerlings Yearlings & Adults.
1. Humpback salmon			
Bucksport, Harriman's Brook	-	400,000	-
Calais, St. Croix R.	-	300,000	-
Cherryfield, Narragaugus R.	-	100,000	-
Columbia Falls, Pleasant R.	-	450,000	8,000
Dennysville, Denny's R.	-	450,000	7,157
East Machias, E. Machias R.	-	100,000	-
East Orland, Alamoosook Lake	-	100,000	-
Ellsworth, Branch Pond	-	45,000	-
Patten Pond	-	45,000	-
Union R.	-	210,000	7,800
Harrington, Small Stream	-	100,000	-
Orland, Orland River	-	1,376,000	336,600
Pembroke, Pennamaquan R.	-	63,000	-
Penobscot, Pierce Brook	-	400,000	-
Perry, Little River Perry	-	66,000	-
South Penobscot, Wight's Brook	-	400,000	-
Total		4,605,000	359,557
2. Rainbow trout			
Bar Harbor, Jordan Pond	-	-	1,000
Benson Siding, Little Benson Lake	-	-	250
Boston Ranch, Special Pond	-	-	500

	Mars Hill, Presque Isle Creek	-	-	250
	Megantic, Arnold Pond	-	-	1,800
	Portland, Duck Pond Brook	-	-	500
	Sanford, Squaw Pond	-	-	500
	Total			4,800
3.	Atlantic salmon			
	East Orland, Penobscot R. East Br.	-	1,804,313	-
4.	Landlocked salmon (total)	100,000	287,042	91,790
5.	Scotch sea trout			
	East Orland, Alamoosook River	-	38,968	-
	Toddy Pond	-	19,462	-
	Total		58,430	
6.	Lake trout			
	Abbot Village, Buttermilk Pond	-	5,000	-
	Enfield, State Fish Comm.	50,000	-	-
	Farmington, Clear Water Lake	-	9,500	-
	Harrington, Schoodic Pond	-	10,000	-
	Locke Mills, Round Lake	-	5,000	-
	South Pond	-	5,000	-
	Nicolin, Branch Pond	-	15,000	-
	Norway, Lake Kewayden	-	10,000	-
	Otis, Great Brook	-	18,723	-
	Pembroke, Pennamaquan Lake	-	12,000	-
	Total	50,000	90,223	

7. Brook trout (total)	100,000	1,511,155	5,000
8. Smelt			
Cherryfield, Tunk Pond	-	2,000,000	-
Dedham, Toddy Pond	-	3,000,000	-
Otis, Great Brook	-	900,000	-
Total		5,900,000	
9. Small-mouth black bass			
Bowdoinham, Adams' Pond	-	1,000	-
Oakland, Belgrade Lake	-	3,200	-
Total		4,200	
10. White perch			
Brooks, Passagassawaukeag Lake	-	400,000	-
Randall Lake		800,000	-
Norway, Lake Kewayden		300,000	
Virginia Lake		900,000	
Wescott, Little Ossipee Lake		600,000	
Total		3,000,000	

1916.

	Eggs	Fry	Fingerlings Yearlings & Adults.
1. Humpbacked salmon			
Bangor, Penobscot River	-	320,000	-
Calais, St. Croix River	-	731,710	-
Dennysville, Denny's River	-	510,840	-
East Machias, East Machias R.	-	738,935	-
Ellsworth, Union River	-	144,515	-
Orland, Orland River	-	2,220,000	229,584
Pembroke, Pennamaquan R.	-	510,840	-
South Penobscot, Wright's Pond	-	420,000	-
Warren, St. George River	-	399,384	-
Total		5,996,224	229,584
2. Steelhead trout			
Dover, Buttermilk Pond	-	-	3,500
Piscataquis River	-	-	1,500
Total			5,000
3. Landlocked salmon (total)	300,000	316,168	52,970
4. Atlantic salmon	-	1,709,815	-
5. Scotch sea trout			
East Orland, Alamoosook Lake	-	-	509
6. Lake trout			
Otis, Green Lake	-	14,637	-
Wilton, Wilson Lake	-	20,000	-

Winthrop, State Fish Comm.	50,000	-	-
Total	50,000	34,637	
7. Brook trout (total)	100,000	444,800	1,402,710
8. Smelt			
Branch Pond, Branch Pond	-	10,000,000	-
Green Lake, Green Lake	-	2,000,000	-
Total		12,000,000	
9. Smallmouth black bass			
Fryeburg, Lake Kezar	-	-	198
10. White Perch			
Belfast, Cross Pond	-	300,000	-
Brooks, Passogassawankeag Pond	-	400,000	-
Prime Pond	-	300,000	-
Randall Pond	-	300,000	-
Lewiston, Tacoma Pond	-	500,000	-
South Paris, Big Concord Pond	-	300,000	-
Wescott, Little Ossipee Lake	-	500,000	-
Total		2,600,000	

1917.

	Eggs	Fry	Fingerlings Yearlings & Adults.
1. Humpback salmon			
Calais, St. Croix River	-	925,050	-
Cherryfield, Narraguagus R.	-	525,000	-
Dennysville, Denny's River	-	1,050,000	-
East Machias, East Machias R.	-	1,050,000	-
Orland, Orland River	-	1,470,600	-
Orono, Penobscot River	-	1,984,339	-
South Penobscot, Wright's Pond	-	506,500	-
Warren, St. George's River	-	386,715	-
Total		7,898,204	
2. Steelhead			
Forest, Farrar Lake	-	27,200	-
3. Rainbow trout			
Farmington, Clearwater Lake	-	-	4,000
Portland, Crooked River	-	-	4,000
Total			8,000
4. Atlantic salmon (total)	-	3,028,850	-
5. Landlocked salmon (total)	401,000	801,199	131,706
6. Lake trout			
Greenville Jct. State Fish Comm.	100,000	-	-
Winthrop, " " "	100,000	-	-
Total	200,000		

7.	Brook trout (total)	100,000	2,263,776	112,150
8.	Smelt			
	Anson, Great Embden Pond	-	4,000,000	-
	Belfast, Quantabacook Lake	-	4,000,000	-
	Brooks, Randall Pond	-	4,000,000	-
	Dedham, Branch Pond	-	600,000	-
	Otis, Green Lake	-	7,400,000	-
	Sullivan, Tunk Pond	-	4,000,000	-
	Waldo, Halfmoon & Mixer Ponds	-	4,000,000	-
	Total		28,000,000	
9.	Largemouth black bass			
	Augusta, Kearns' pond	-	-	50
	Livermore Falls, Tilton Pond	-	-	225
	Total			275
10.	Smallmouth black bass			
	Machias, Hadley Lake	-	-	400
	Oakland, Little Pond	-	-	600
	Princeton, Big Lake	-	-	400
	Lewey Lake	-	-	500
	Long Lake	-	-	400
	Readfield, Echo Lake	-	-	400
	Total			2,700
11.	Pike Perch			
	Orono, Pushaw Lake	-	500,000	-

1919.

	Eggs	Fry	Fingerlings Yearlings & Adults
1. Steelhead salmon			
Farmington, Clearwater Lake	-	-	1,011
Grand Lake, Grand Lake	-	-	34,938
Hiram, Hancock Brook	-	-	400
Otis, Green Lake	-	-	11,232
Total			47,581
2. Atlantic salmon (total)	-	2,389,500	700
3. Landlocked salmon	405,127	280,370	146,200
4. Rainbow trout			
Portland, Pleasant River	-	-	800
5. Brook trout (total)	-	1,277,180	127,545
6. Small mouth black bass			
Bath, Lake Nequassett	-	1,500	-
Lily Pond	-	1,000	-
Boothbay Harbor, Campbell Pond	-	1,500	-
Bridgton, Highland Lake	-	2,000	-
Ellsworth, Walker Pond	-	-	60
Fryeburg, Kezar Lake	-	2,500	-
Lovewell Pond	-	1,500	-
Gray, Dry Pond	-	-	200
Livermore Falls, David's Pond	-	1,500	-

Oakland, Little Pond	-	1,500	-
Poland, Lake Thompson	-	-	285
Sandy Creek, Woods Pond	-	3,500	-
Total		16,500	545

1921.

1.	Atlantic salmon	-	1,387,000	280
2.	Brook trout	256,890	1,730,930	-
3.	Lake trout	50,000	-	-
4.	Landlocked salmon	375,000	208,115	108,400
5.	Rainbow trout	-	26,000	-
6.	Smelt	-	7,000,000	-
7.	Sockeye salmon	-	17,500	-

1923.

		Eggs	Fish
1.	Atlantic salmon		491,038
2.	Landlocked salmon		809,070
3.	Lake trout	50,000	
4.	Brook trout		913,900
5.	Smelt	16,280,000	28,000,000
6.	Small mouth black bass		3,169
7.	White perch		675

1924.

		Fish
1.	Humpback salmon	353,580
2.	Atlantic salmon	501,000
3.	Landlocked salmon	862,290
4.	Rainbow trout	9,120
5.	Lake trout	9,296
6.	Brook trout	1,078,150
7.	Smelt	9,300,000
8.	Crappie	110
9.	Large mouth black bass	1,700
10.	Small mouth black bass	1,000

1925.

1.	Atlantic salmon	1,422,500
2.	Landlocked salmon	970,880
3.	Rainbow trout	1,200
4.	Loch Leven trout	480
5.	Lake trout	30,450
6.	Brook trout	1,172,148
7.	Small mouth black bass	6,095

1926.

		Fish & fish eggs
1.	Humpback salmon	998,000
2.	Landlocked salmon	554,155
3.	Brook trout	1,119,880
4.	Crappie	600
5.	Large mouth black bass	100
6.	Small mouth black bass	2,455

Summary.

1. Thirty-nine species of fresh-water fishes are indigenous to the waters of Maine.

2. This small number of unrelated species in Maine makes it possible to develop a key for use as an aid in their identification. Such a key has been developed as a result of this investigation. The key is supplemented by illustrations of most of the fish and by their technical descriptions.

3. The general distribution in the State of Maine, as recorded by the principal river basins, as well as the range in the United States is stated for each species.

4. The fish fauna of Maine is changing, due to several reasons. (a) Deforesting of areas around streams and brooks raises the temperature of the water and lowers the water level. In such regions the native brook trout will disappear and other fishes suited to these conditions may become dominant. It is possible, however, that a return of former conditions may bring return of trout. (b) Introduction of non-indigenous species may cause depletion of native fish due to the voracious habits of the newcomers, or to lack of food, brought about by overstocking. (c) Other factors such as pollution of the water and untimely fishing cause a decrease in the number of fish.

5. Twenty species of non-indigenous fresh-water fish have been introduced into the waters of the State of Maine.

6. Of these introduced non-indigenous species nine are known to

have survived and become acclimated in Maine waters.

7. Landlocked salmon, (Salmo sebago) originally occurring in four Maine ponds have been successfully introduced into many of the lakes of the State.

8. Discrimination must be practised in introducing non-indigenous fish owing to the fact that the native fish may disappear. There are some species, ie., that are apparently adapted and useful that may profitably be introduced in some waters and there are other species apparently adapted but harmful to the native population. It would seem advisable to maintain trout brooks as such until a fish is found which is superior to the native species.

9. The present policy of introducing fewer species is justified. However, there are some being introduced, like the crappie and the basses, whose value is questionable.

10. Time and labor should be spent on the introduction of trout and landlocked salmon. Tourists come to Maine for trout as they are not found to any extent further south.

11. The number of eggs and fry released in Maine streams and lakes is out of proportion to the numbers of adult fish recovered subsequently in the same waters. This appears to be due to a lack of appreciation of the importance of taking into consideration environmental and biological factors governing the success of the species released.

12. It is indicated that further biological investigation

should be undertaken to determine the reasons for the high mortality of an introduced or restocked species and to provide, if possible, more exact information concerning the probability of the success of fish so released.

13. The application of methods of biological control to Maine waters would unquestionably lead to further development of the aquatic resources of the State.

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